



RESIDENTIAL CONSTRUCTION HANDBOOK

Source: 2018 NC State Residential Code

PREFACE

This booklet was published to assist customers with some of the most commonly asked questions about the North Carolina Residential Code. The current edition of the North Carolina Residential Code became effective on January 1, 2019. This handbook is to be used as only a guide and is not intended to be a substitute for the current North Carolina Residential Building Code. Great care has been taken within this booklet to provide the newest version of the code including any amendments made to the current code. If a conflict is found between these two publications, the current North Carolina Residential Code will prevail. Code references from the 2018 North Carolina Residential Building Code (**NCRC**) and the 2018 North Carolina Administrative Code and Policies (**NCACP**) are listed for referral to the code. Underlined text represents code language added by North Carolina to the International Residential Code which was used as the base code.

Should you need additional information regarding a code interpretation, you can refer to the North Carolina Department of Insurance (NCDOL) website.
https://ncdoi.com/OSFM/Engineering_and_Codes/Default.aspx?field1=Code_Interpretations&user=State_Building_Codes

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Mecklenburg County Code Enforcement
2145 Suttle Avenue Charlotte, NC 28208-5237
980-314-CODE (2633)
www.meckpermit.com

Customer Service	980-314-2633 + prompts
Permitting	980-314-2633 + prompts
Documents/Inspections	980-314-2633 + prompts
Revenue Collections	980-314-2633 + prompts
Fax	866-851-3630
Project Controllers:	
Residential	980-314-2633 + prompts
Commercial	980-314-2633 + prompts
Inspections by Appointment & Overtime Inspections	704-200-4940
Zoning	
Charlotte	704-336-7600
Cornelius	704-8962461
Davidson	704-892-7591
Huntersville	704-875-7000
Matthews	704-507-3380
Mint Hill	704-545-9726
Pineville	704-507-3380

Mecklenburg County Health Department	
Wells & Septic Systems	980-314-1680
Charlotte Planning	704-336-2205
Mecklenburg County Register of Deeds	704-336-2443
Mecklenburg County Tax Office	704-336-7600
Lead Paint – Raleigh	919-707-5950

Additional information is available at www.meckpermit.com

RESIDENTIAL PLAN SUBMITTAL PROCESS

1. Residential construction projects that are less than 100 square feet do not require plan review.
2. Decks and screened porches do not require plan review.
3. The Residential Drawing Submittal Checklist has also changed. Please refer to our website www.meckpermit.com for the most current requirements for plan submittal.

Basic requirements for plan submittal are: Plans shall be drawn to scale.

1. Designer, engineer, or architect name, telephone and address.
2. Property owner name/ address/ name of job.
3. Plan size: a minimum 8.5 by 11 inches for projects 500 square foot and under.
4. Plan size: a minimum 11 by 17 inches for projects over 500 square feet.
5. Plans should show all dimensions of footings, foundations, framing details (floor, wall, roof) and elevations. Provide all construction material types including roof, wall coverings and energy requirements.
6. Details regarding the residential plan review process and requirements can be found at:
<https://www.mecknc.gov/LUESA/CodeEnforcement/PlanReview/Pages/Residential%20Plan%20Review.aspx>

PERMITS

1. When is a permit required?

NCACP Section 204.3.1 No person may commence or proceed with the construction, reconstruction, alteration, repair, movement to another site, removal or demolition of any building without first securing from the Inspection Department having jurisdiction, any and all permits required by the State Building Code.

EXCEPTION: Permits shall not be required for any work costing fifteen thousand dollars or less, UNLESS THE WORK INVOLVES:

- a. The addition, repair or replacement of load bearing members or structures;
- b. The installation, extension of any plumbing system; general repair may not need a permit to be performed.
- c. The installation, extension, alteration of any heating or cooling system; general repair may not need a permit to be performed.
- d. The installation, extension, alteration of an electrical wire system;
- e. The use of materials not permitted by this code; or
- f. The addition of roofing, excluding replacement of like grade or fire resistance roofing.

2. Is labor cost included in the total cost of the permit valuation?

NCACP Section 204.6 Yes, permit valuations shall include total cost, such as electrical, gas, mechanical, plumbing equipment, fire protection and other systems, including materials and labor.

3. Does an accessory building need to be permitted?

Section R101.2.1 Accessory buildings.

Accessory buildings with any dimension greater than 12 feet (3658mm) must meet the provisions of this code. Accessory buildings may be constructed without a masonry or concrete Foundation, except in coastal high hazard or ocean hazard areas, provided all of the following conditions are met.

1. The accessory building shall not exceed 400 square feet or one story in height.
2. The building is supported on a wood foundation of minimum 2x6 or 3x4 mudsill of approved wood in accordance with Section R317, and
3. The building is anchored to resist overturning and sliding by installing a minimum of one ground anchor at each corner of the building. The total resisting force of the anchors shall be equal to 20psf (958 Pa) times the plan area of the building.

Not all accessory buildings will require a permit. Any building where **all** dimensions, including the mean roof height, are 12 ft or less does not require building permits and would only require a zoning permit.

4. Does an accessory structure need to be permitted?

R101.2.2 Accessory Structures. Accessory structures are not required to meet the provisions of this code except decks, gazebos, retaining walls as required by Section R404.4, detached masonry chimneys built less than 10' from other buildings, pools or spas per appendix V, or detached carports. Other examples of accessory structures not requiring a permit are fencing, arbors (unless attached to the house or a deck), BBQ. pits, playground equipment and yard art.

Exception: Portable lightweight aluminum or canvas type carports not exceeding 400 sq. ft. or 12' mean roof height and tree houses supported solely by a tree are exempt from the provisions of this code.

INSPECTIONS

Process

The work being scheduled for inspection shall be ready at the time the inspection request is made. The Division's goal is 85% or better of inspections performed on the date requested and requests can be made by phone, on our automated system by calling 704-336-8000, or account holders can go online at www.meckpermit.com and sign into their account dashboard to request an inspection. If assistance is needed you can contact our administrative or customer service team at 980-314-2633. All inspection results are public records and available for viewing on our website at www.meckpermit.com. The General Contractor or property owner shall make inspection request for the Building Permit. Requests for electrical, plumbing or mechanical inspections shall be made by the trade contractors listed on the permit when part of a project. The inspections and procedures outline below will assist you in understanding the requirements for obtaining all State required inspections however if there is any question concerning what's required please discuss with your inspector.

Needed on Site

For an inspection, the following is needed on site:

- Job must be ready for the inspection requested.
- Address must be plainly visible from the street (Placard or other).
- Required approved plans on site.
- All pertinent information needed for site review shall be included with plans such as truss layouts and design sheets, I-joists layout or beam specifications when installed.

There are no partial residential inspections other than partial rough trade inspections for under slab areas and the optional inspections listed below, all the permitted work for the type of inspection request should be ready at time of request.

Inspection Requirements

The following is an outline of the different types of inspections Mecklenburg County provides, both required by the State under Section 107 of the NC Administrative Code and Policies and optional inspections requested by a permit holder.

(FT) Footing Inspection

To be scheduled after the trenches are excavated, all grade stakes are installed, all reinforcing steel and supports are in place and approximately tied, all necessary forms and bulkheads are in place and braced, but **before any concrete is placed**. All filled building lots require a Subgrade Verification Form found on our website at www.meckpermit.com. Footer width is measured at the base of the trench and should be at least 12" below grade at the time of the inspection.

(MS or SL) Under Slab Inspection

To be scheduled after all forms have been placed, all electrical, plumbing and/or heating and air conditioning facilities in place, all crushed stone, vapor retarder, reinforcing steel with supports and ties, and all welded wire fabric is installed, when required. All thickened areas and grade beams must be installed.

Exception: Inspection is not required for driveway slabs, patio slabs, sidewalks (exterior flat work), etc., however a driveway or any flat concrete work that is within 10' of the structure will need to be installed by final inspection if drainage away from a building's foundation is a concern.

(FD) Foundation Inspection

To be scheduled after all foundation supports or piers are installed and prior to backfill on the exterior or interior of the foundation. This inspection is to check the placement of the foundation walls on footers, the foundation itself, the anchor bolts or straps and the ground clearance. The crawl space leveling, backfilling and positive drainage will be inspected with the framing inspection. Insulation shall not be installed on the foundation walls (closed crawl space) or floor

systems installed prior to foundation inspection. The foundation damp-proofing/waterproofing should not be installed until after the foundation inspection. Although damp-proofing/waterproofing along the drainage is a requirement of the code, under certain conditions, there is not a required inspection specifically for it.

(RF) Rough-In Inspections, all trades

To be scheduled when all framing is complete, and the building is dried in (roofing felt or shingles in place). All parts of the plumbing, mechanical, and electrical system which will be hidden from view in the finished building must be complete and ready for inspection.

(FR) Building Framing Inspection

To be scheduled after the roof (*minimum felt paper and roof boots*), wall, ceiling and floor framing is complete with appropriate blocking, bracing and fire stopping in place. The following items should be in place and visible for inspection:

1. Insulation baffles when required;
2. Chimneys, vents, flashing for roofs and wall openings;
3. All trade rough-ins must be complete;
4. Windows and exterior doors should be installed and flashed;
5. Exterior weather barrier installed;
6. All brick lintels that are required to be bolted to the framing for support shall be in place. Lintels that are supported by brick or masonry as it is installed will be inspected at a later date;
7. All penetrations in wall plates must be fire stopped;
8. Crawl space penetrations must be caulked to prevent air movement.

(IN) Insulation Inspection

To be scheduled after the building framing and trade rough- in inspections are complete. All wall insulation must be in place. Depth markers for blown in attic insulation are required every 300 sq. ft. of attic at the wall insulation inspection.

Chimney insulation must be properly secured to prevent contact with the firebox. Blown in attic insulation and crawl space insulation should be installed after dry wall and inspected with the final inspection.

(FI) Final Inspection

Final inspections should be made for each trade after completion of the work authorized under the technical codes. All projects shall be accessible for inspection between 8 a.m. and 5 p.m., Monday – Friday or by appointment. The project is not finished until all final inspections are complete. A building final is required before utility services will connect for new structures. Floor coverings are not required to be installed for any final inspections except in bathroom areas under a water closet. All plumbing fixtures must be installed. Rough grades must be complete and all driveways, walks and patios may need to be installed to verify slope away from structure. Permanent addresses shall be posted on all new dwellings and all permanent handrails/guards installed.

Other Inspections

In addition to the inspections listed above, the Inspections Team may require other inspections to ascertain compliance with the Residential Code based upon specific project issues or construction methods utilized on a given project.

Optional Inspections

There are several inspections that are optional services at the request of the permit holder, some optional inspections have additional fees as listed below:

- A. **(SH)**-Sheathing/energy encapsulation inspections. A distinction of the specific inspection (sheathing or energy encapsulation) must be included in the inspection request. This inspection is

made when the permit holder wishes to install exterior covers before the full framing inspection is ready or when interior areas need to be insulated and encapsulated before setting shower/tubs & fireplaces. One- and two-family dwellings are charged \$50.00 each trip and townhouses are charged \$25.00 each.

- B. **(TU)**-Temporary utilities inspections. This is for temporary electrical (TP) or heat (TH) to a structure prior to a final approval, no occupancy allowed. The cost for TP (electrical) is \$90 per open trade on a permit and TH (gas) is \$90 per open trade on the permit.
- C. **(SS)**-Saw Service. Saw service is available with an electrical permit that has been issued for the project and there is no additional fee for a saw service inspection.

Additional Information

Please check our website www.meckpermit.com for additional information covering:

- 1. **Auto-notification** (alerts you when your inspection is next)
- 2. **Recap fees** (additional charges or credit for your project's pass-rate). (See the fee ordinance pass rate incentive program).
- 3. **Inspection By Appointment (IBA)** (this is a premium service with an additional fee to set an appointment for a specific time for an inspection).
- 4. **H1-Homeowner access program** (this feature allows contractors to setup an inspection at no charge for an inspector to call a homeowner to make an appointment for access to their home).

BUILDING PLANNING

- 1. When is a one-hour exterior wall required in a single-family residence?

Section R302 Exterior walls with a fire separation distance less than 3 feet shall have not less than a one-hour fire- resistive rating for fire exposure from both sides. Projections beyond the exterior wall shall not extend more than 12 inches. Openings shall not be permitted in exterior walls less than 3 feet from the property line. This distance shall be **measured perpendicular to the line used to determine the fire separation distance.**

TABLE R302.1
EXTERIOR WALLS

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119 or UL 263 with exposure from both sides	< 3 feet
	Not fire-resistance rated	0 hours	≥ 3 feet
Projections	Fire-resistance rated	1 hour on the underside	< 3 feet
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	N/A	< 3 feet
	Unlimited	0 hours	3 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet

For SI: 1 foot = 304.8 mm.
N/A = Not Applicable.

Source: 2018 N.C. Residential Building Code

2. **What are the requirements for openings from a garage into a dwelling?**

Section R302.5.1 Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1-3/8 inches (35 mm) in thickness, solid or honeycomb core steel doors not less than 1-3/8 inches (35 mm) thick, or 20-minute fire-rated doors.

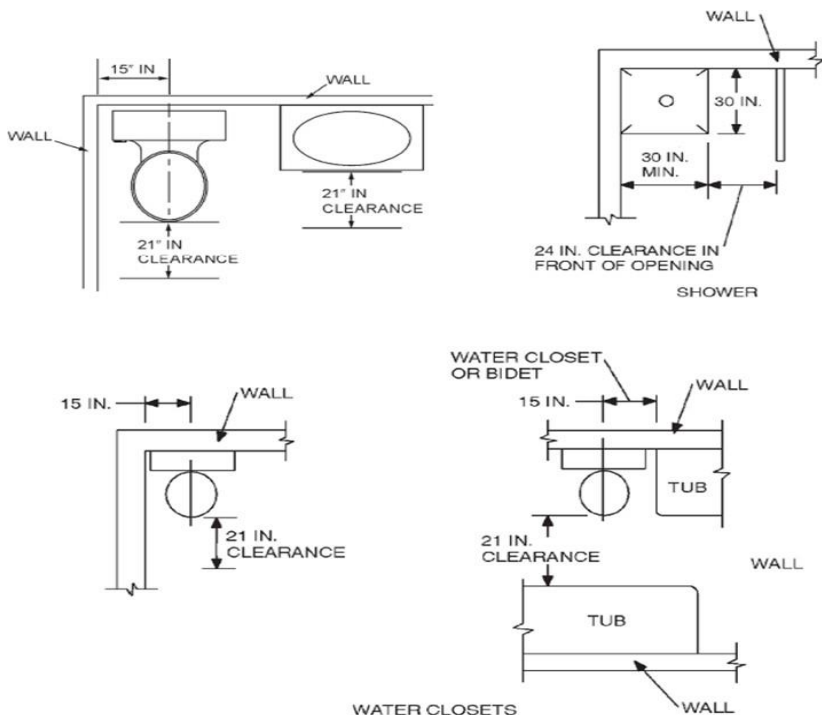
Exception: A disappearing/pull-down stairway to uninhabited attic space with minimum 3/8-inch (nominal) fire retardant-treated structural panel is deemed to meet Table R302.6 Dwelling/Garage Separation of not less than ½-inch gypsum board or equivalent applied to garage side.

3. **Is a window required in a bathroom?**

Section R303.3 Bathrooms, water closet compartments and other similar rooms shall be provided with an aggregate glazing area in

windows of not less than 3 square feet, one-half of which must be operable.

Exception: The glazed areas shall not be required where artificial light and a mechanical ventilation system are provided. The minimum ventilation rates shall be 50 cfm for intermittent ventilation or 20 cfm for continuous ventilation. Ventilation air from the space shall be exhausted directly to the outside.



**FIGURE R307.1
MINIMUM FIXTURE CLEARANCES**

Source: 2018 N.C. Residential Building Code

4. What is the minimum ceiling height?

Section R305 Habitable space, hallways, and portions of basements containing these spaces shall have a ceiling height of not less than 7 feet (2134 mm). Bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches.

Section R305.1.1 Portions of basements that do not contain habitable space or hallways shall have a ceiling height of not less than 6 feet 8 inches.

Exceptions:

- a) For rooms with sloped ceilings, the required floor area of the room shall have a ceiling height of not less than 5 feet and not less than 50 percent of the required floor area of the room must have a ceiling height of at least 7 feet.
- b) The ceiling height above bathroom and toilet room fixtures shall be such that the fixture is capable of being used for its intended purpose. A shower or tub equipped with a showerhead shall have a ceiling height of not less than 6 feet 8 inches above an area of not less than 30 inches by 30 inches at the showerhead. Shown in Figure R307.1. (See Next Page)
- c) Beams, girders, ducts or other obstructions in habitable space shall be permitted to project to within 6 feet 4 inches of the finished floor.

5. What is required for a stairway?

R311.7.1 Width. Stairways shall not be less than 36 inches in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4.5 inches on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31½ inches where a handrail is installed on one side and 27 inches where handrails are provided on both sides.

Exception: The width of spiral stairways shall be in accordance with Section R311.7.10.1. Stairways not required for egress may be a minimum width of 26 inches.

6. What are the requirements for smoke alarms?

Section R314.3 Location. Smoke alarms shall be installed in the following locations:

- a) In each sleeping room.
- b) Outside each separate sleeping area in the immediate vicinity

of the bedrooms.

- c) On each additional story of the dwelling, including basements and habitable attics (finished) and not including crawl spaces, and uninhabitable (unfinished) attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.
- d) Smoke alarms shall be installed not less than 3 feet horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by section R314.3.

When more than one smoke alarm is required to be installed within an individual dwelling unit the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual unit.

Exception: Interconnection of smoke alarms in existing areas shall not be required where alterations or repairs do not result in removal of interior wall or ceiling finishes exposing the structure.

7. When and where are CO₂ alarms required?

R315.1 Carbon monoxide alarms. Carbon monoxide alarms shall be listed in accordance with UL 2034. Combination carbon monoxide and smoke alarms shall be listed in accordance with UL 2034 and UL 217.

For new construction, carbon monoxide alarms shall be provided in dwelling units where either or both of the following conditions exist.

- a) The dwelling unit contains a fuel-fired appliance or fireplace.
- b) The dwelling unit has an attached garage with an opening that communicates with the dwelling unit.

R315.2.2 Alterations, repairs and additions. Where alterations, repairs or additions requiring a building permit occur, or where one or more sleeping rooms are added or created in existing dwellings, or where fuel-fired appliances or fireplaces are added or replaced,

the individual dwelling unit shall be equipped with carbon monoxide alarms located as required for new dwellings.

Exception: Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck, or the installation of a fuel-fired appliance that cannot introduce carbon monoxide to the interior of the dwelling, are exempt from the requirements of this section.

R315.3 Location. Carbon monoxide alarms in dwelling units shall be installed outside of each separate sleeping area in the immediate vicinity of the bedrooms. Where a fuel-burning appliance is located within a bedroom or its attached bathroom, a carbon monoxide alarm shall be installed within the bedroom.

R315.5 Power source. Carbon monoxide alarms shall receive power their power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery.

Exception: Carbon monoxide alarms shall be permitted to be battery operated where installed in buildings without commercial power. Carbon monoxide alarms installed in accordance with section R315.2.2 shall be permitted to be battery power.

8. How many vents are required in a foundation?

R408.1.1 Foundation vent sizing. The minimum net area of ventilation openings shall be not less than 1 square foot for each 150 square feet of crawl space ground area.

Exception: The total area of ventilation openings may be reduced to 1/1,500 of the under-floor area where the ground surface is treated with an approved vapor retarder material in accordance with Section R408.2 and the required openings are placed to provide cross-ventilation of the space. The installation of operable louvers shall not be prohibited.

FOOTINGS

1. When is a footing inspection required?

NCACP Section 107.1.1 Footing inspections shall be made **after** the trenches are excavated, all grade stakes are installed, all reinforcing steel and supports are in place and tied, and all necessary forms are in place and braced **before** any concrete is placed.

2. When is a soil test required?

Section R401.4 Where quantifiable data created by accepted soil science methodologies indicate expansive, compressible, shifting or other questionable soil characteristics are likely to be present, the building official shall determine whether to require a soil test to determine the soil's characteristics at a particular location. This test shall be done by an approved agency using an approved method. (Soil test will also be required when the existing soils do not meet the assumed 2000 psf. or when the design requires a greater soil bearing capacity).

3. Is 2500 psi concrete the minimum allowable for footings?

Section R402.2 Yes, but only under moderate weather conditions. See Table R402.2 for other concrete applications.

4. What is the minimum depth of a footing?

Section R403.1.4 All exterior footings and foundation systems shall extend below the frost line specified in Table R301.2(1). In no case shall the bottom of the exterior footings be less than 12 inches below the finished grade.

Exception: Footings and foundations erected on solid rock shall not be required to extend below the frost line.

5. Does a footing need to be level?

Section R403.1.5 The top surface of footings shall be level (1/2 inch in 10 feet) or shall be brought level, under the width of the wall, with masonry units with full mortar joints. The bottom surface of footings may have a slope not exceeding one-unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings

will exceed one-unit vertical in ten units horizontal (10-percent slope). Illustration of page 22.

6. What is the minimum footing size for a masonry fireplace?

Section R1003.2 Footings for masonry chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 12 inches (305 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall not be less than 12 inches below finished grade.

TABLE R403.1(1) MINIMUM WIDTH OF CONCRETE, PRECAST OR MASONRY FOOTINGS (inches) ^a				
LOAD-BEARING VALUE OF SOIL				
load				
	1,500	2,000	3,000	4,000
Conventional light-frame construction				
1-story	12 ^b	12 ^b	12	12
2-story	15 ^b	12 ^b	12	12
3-story	23	17	12	12
4-inch brick veneer over light frame or 8-inch hollow concrete masonry				
1-story	12 ^b	12 ^b	12	12
2-story	15 ^b	12 ^b	12	12
3-story	22	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	12 ^b	12	12
2-story	20	21	14	12
3-story	42	32	21	16

For SF: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.
^a Where minimum footing width is 12 inches, use of a single wythe of solid or fully grouted 12-inch nominal concrete masonry units is permitted.
^b A minimum footing width of 12 inches is acceptable for monolithic slab foundations.

1 (One) Story			2 (Two) Story	
Area	Pier	Footing	Pier	Footing
50	8" x 16"	1' - 4" x 2' - 0" x 8"	8" x 16"	1' - 4" x 2' - 6" x 8"
100	8" x 16"	1" - 4" x 2' - 0" x 8"	8" x 16"	2' - 0" x 2' - 0" x 10"
150	8" x 16"	2' - 0" x 2' - 0" x 8"	16" x 16"	2' - 8" x 2' x - 8" x 10"
200	8" x 16"	2' - 4" x 2' - 4" x 10"	16" x 16"	3' - 0" x 3' - 0" x 10"
250	—	—	16" x 16"	3' - 4" x 3' - 4" x 1' - 0"
300	—	—	16" x 16"	3' - 8" x 3' - 8" x 1' - 0"

2 1/2 (Two & One Half) Story		
Area	Pier	Footing
50	8" x 16"	1' - 4" x 2' - 6" x 8"
100	16" x 16"	2' - 6" x 2' - 6" x 10"
150	16" x 16"	3' - 0" x 3' - 0" x 10"
200	16" x 16"	3' - 11" x 3' - 8" x 1' - 0"
250	16" x 24"	4' - 0" x 4' - 0" x 1' - 0"
300	16" x 24"	4' - 6" x 4' - 6" x 1' - 0"

* SEE NEXT PAGE FOR
FOOTNOTES

****SEE NOTES BELOW**

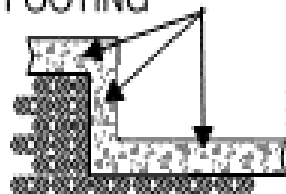
TABLE 403.1(2)

**For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch
= 6.895 kPa, 1 pound per square foot = 0.0479 kPa**

1. Pier sizes are based on hollow CMU capped with 4 inches of solid masonry or concrete for 1 (one) story and 8 inches of solid masonry or concrete for 2 (two) and 2-1/2 (Two and one half) story houses or shall have cavities of the top course filled with concrete or grout or other approved methods. Mortar shall be Type S. A minimum footing of 12 inches is acceptable for monolithic slab foundations.
2. Footing sizes are based on 2000 psf. allowable soil bearing and 2500 psi concrete. This table is based upon the limitations of a tributary area using dimensional framing lumber only.
3. Centers of piers shall bear in the middle one-third of the footings. Girders must have full bearing on piers. Footings shall be full thickness over the entire area of the footing.
4. Pier sizes given are minimum. For height/thickness limitations see Section R606.6.
5. Area in table is for first level being supported by pier and footing (square foot).

Source: 2018 N.C. Residential Building Code

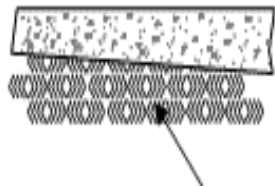
MAINTAIN THICKNESS THROUGHOUT STEP FOOTING



UNDISTURBED OR
CONTROLLED FILL

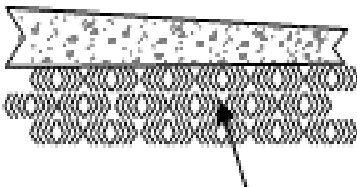
- NOTES:
1. FOOTING SIZES ARE BASED ON SOIL WITH ALLOWABLE SOIL PRESSURE OF 2000 POUNDS PER SQUARE FOOT. FOOTINGS ON SOIL WITH LOWER ALLOWABLE SOIL PRESSURE SHALL BE DESIGNED IN ACCORDANCE WITH CURRENT ENGINEERING PRACTICES.
 2. FOOTING PROJECTIONS SHALL NOT EXCEED THE FOOTING THICKNESS
 3. EXTERIOR FOOTINGS SHALL NOT BE EXTENDED BELOW THE FROST LINE UNLESS OTHERWISE PROTECTED AGAINST FROST HEAVE. IN NO CASE SHALL EXTERIOR FOOTINGS BE LESS THAN 12 INCHES BELOW GRADE.

MAXIMUM SLOPE AT THE BOTTOM
OF FOOTING 1 IN 10 INCHES.



IF BOTTOM OF FOOTING EXCEEDS
THIS REQUIREMENT FOOTING
MUST BE STEPPED AS ABOVE

1/2" IN 10 FEET MAXIMUM
SLOPE TOP OF FOOTING



UNDISTURBED OR
CONTROLLED FILL

FOUNDATIONS

1. When is a foundation inspection required?

NCACP Section 107.1.3 To be made after all foundation supports are installed. (These inspections are conducted to verify correct installation and proper bearing support. Poured concrete and masonry walls that have reinforcement steel should be inspected prior to concrete placement. Crawl space leveling, ground clearances, positive drainage and waterproofing/damp-proofing, when required, may be inspected at future inspections prior to concealment). Do not backfill footings until after this inspection.

2. What is the maximum number of stories allowed to be constructed on a pier and curtain wall?

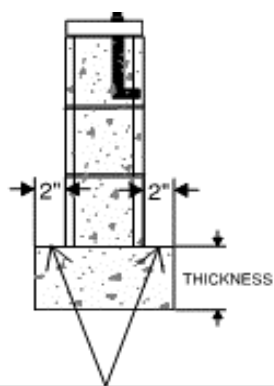
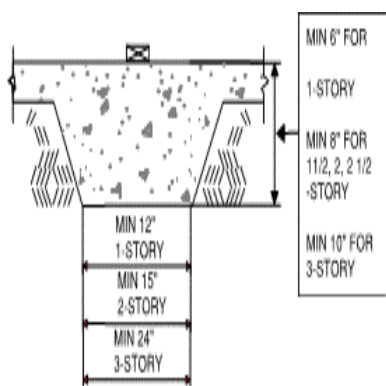
Section R404.1.5.3 Not more than 2 stories in height. The pier and curtain wall shall not exceed 6 feet in height. (other restrictions apply per R404.1.5.3).

3. What is the maximum unsupported height of masonry piers?

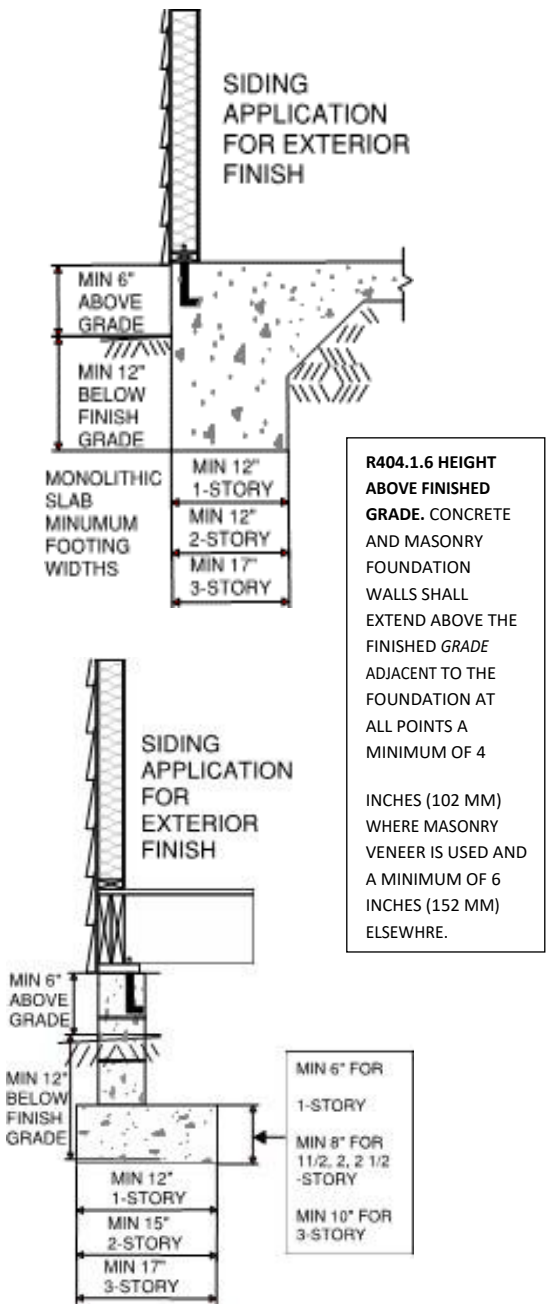
Section R404.1.5.4 & R606.7 The maximum unsupported height of **hollow** masonry piers is 4 times the least dimension of the pier. For **solid** masonry piers, the maximum is 10 times the least dimension of the pier.

4. Are solid masonry units required to have full bed and head joints?

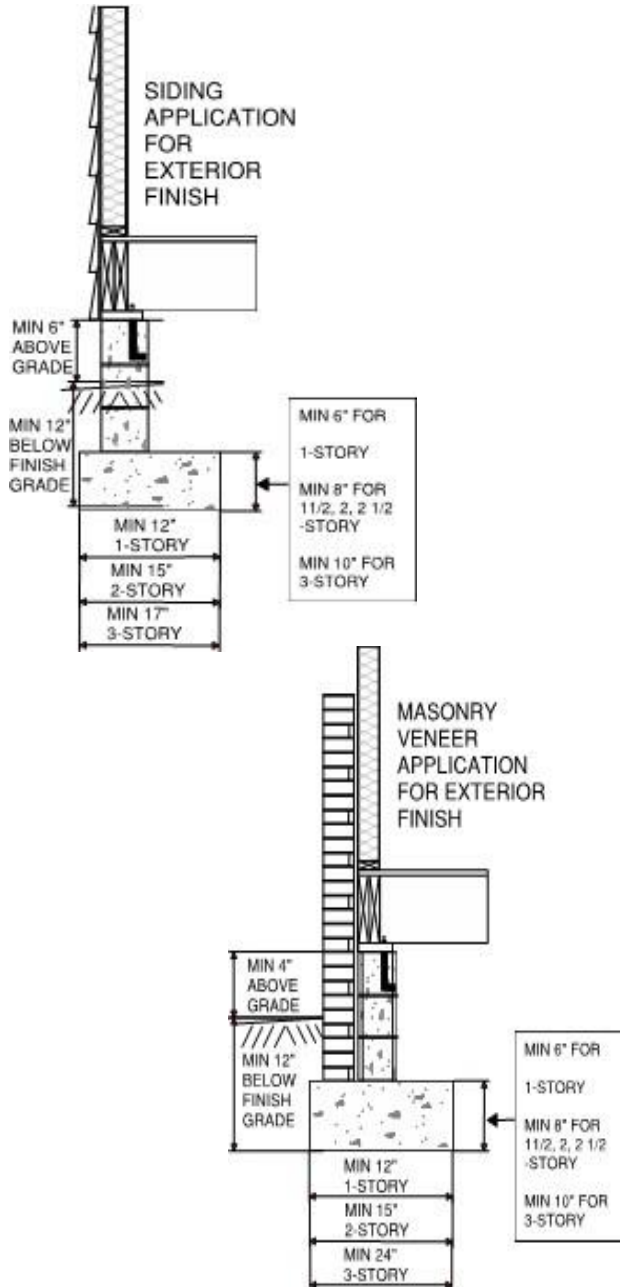
Section R606.3.2.1 & R606.3.2.2 All solid or hollow masonry units shall be laid with full head and bed joints.



Source: 2018 N.C. Residential Building Code



Source: 2018 N.C. Residential Building Code



SLABS

1. When is a slab inspection required?

NCACP Section 107.1.2 Under slab inspections, as appropriate shall be made after all materials and equipment to be concealed by the concrete slab are completed. This includes all forms, under slab electrical, plumbing and/or heating and air conditioning, crushed stone, vapor retarder, reinforcing steel with supports tied and/or welded wire fabric is installed, when required. All thickened areas and grade beams must be installed. Verification of termite protection method/application is required at this time.

Exception: An inspection is not required for driveway slabs, patio slabs, sidewalks, etc. which are considered non-habitable spaces.

2. Are footings required under interior load-bearing walls in slab on grade construction?

Section R403 Yes, footings are required under interior load-bearing walls and all other load-bearing conditions. See illustrations on page 24.

3. When is a 4" base required under slabs and what material should be used?

Section R506.2.2 A 4-inch thick base course consisting of clean graded sand, gravel, crushed stone or crushed blast-furnace slag passing a 2-inch sieve shall be placed on the prepared sub grade when the slab is below grade.

Exception: A base course is not required when the concrete slab is installed on well-drained or sand-gravel mixture soils classified as Group I according to the United Soil Classification System in accordance with Table R405.1.

4. How much backfill is allowed before a compaction test would be required?

Section R506.2.1 Fill material shall be free of vegetation and foreign material. The fill shall be compacted to assure uniform support of the slab, and except where *approved*, the fill depths shall not exceed 24 inches for clean sand or gravel and 8 inches for earth. A compaction test is required when fill placement exceeds

24" in depth. A compaction test may also be required under certain soil conditions.

5. What is the correct lap of a vapor barrier?

Section R506.2.3 A 6 mil polyethylene or approved vapor retarder with joints lapped not less than 6 inches shall be placed between the concrete floor slab and the base course or the prepared subgrade where no base course exists.

Exceptions: The vapor retarder may be omitted:

- a) Garages (detached), utility buildings and other unheated accessory structures.
- b) Unheated storage rooms having an area of less than 70 square feet and carports.
- c) Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
- d) Where approved by the building official, based on local site conditions.

6. What is the minimum specified strength (psi) of concrete for slabs on grade?

Table R402.2 Basement slabs and interior slabs on grade require 2500 psi concrete. Porches, carport slabs and steps exposed to weather and garage floors require 3000-psi air entrained concrete.

7. What is the required attachment for framed walls for slabs and masonry foundations?

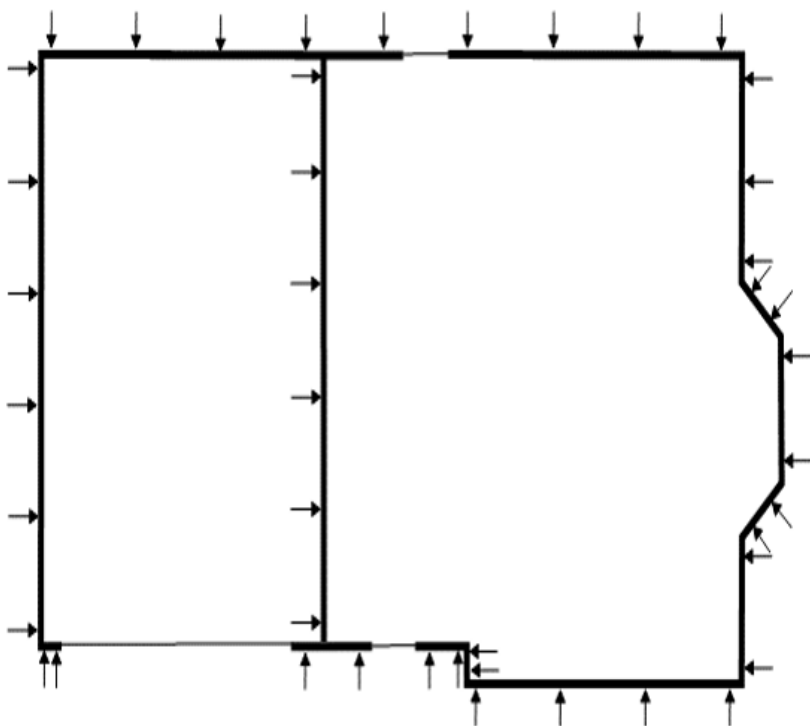
Section R403.1.6 The wood sole plate at exterior walls on monolithic slabs, wood sole plates of braced wall panels at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum ½ inch diameter anchor bolts spaced a maximum of 6 feet on center or approved anchors or anchor straps spaced as required to provide equivalent anchorage to ½-inch diameter anchor bolts. Bolts shall extend a minimum of 7 inches into concrete or grouted cells of masonry units. The bolts shall be located in the middle third of the width of the plate. A nut and washer shall be tightened on each anchor bolt. There shall be a minimum of two bolts per plate section with one bolt located not more than 12 inches from the corner. Interior bearing wall sole

plates on monolithic slab foundation that are not part of a braced wall panel shall be positively anchored with approved fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318.

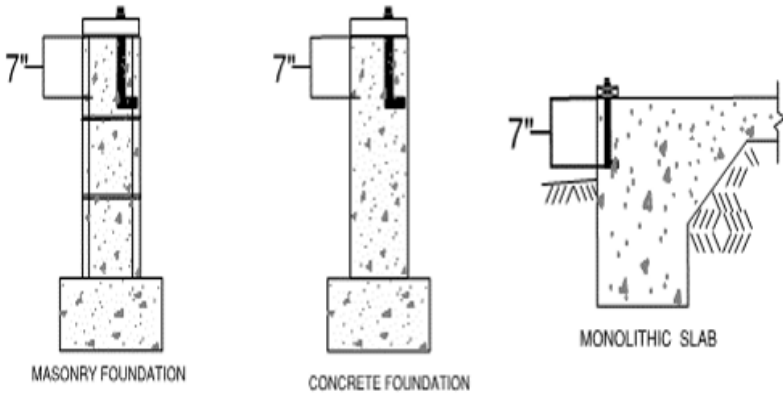
Exceptions:

- a) Walls 24 inches total length or shorter connecting offset braced wall panels shall be anchored to the foundation with a minimum of one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels at corners as shown in Table R602.3(1).
- b) Connection of walls 12 inches total length or shorter connecting offset braced wall panels to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent braced wall panels at corners as shown in Table R602.3(1).

Bolting Locations and Installations



Bolting Locations and Installations



Source: 2018 N.C. Residential Building Code

TYPES OF BOLTS OR STRAPS	BRAND NAME	LOCATION-SPACING
1/2 anchor bolt w/washer (2)	N/A	Within 12" of each corner & 6' o.c. min 7" embedment
22 3/4" anchor strap (4)	SIMPSON MAB 23	Per Manufacturers' Instructions
14 1/2" anchor strap (4)	SIMPSON MAB 15	Per Manufacturers' Instructions

Bolting Locations and Installations

1. See illustration on pages 27 & 28 in this booklet for installation locations for above.
2. There shall be a minimum of 2 bolts per plate section.
3. Bolts shall extend a minimum of 7" into masonry or concrete.
4. Embedment depth of anchor straps shall be per manufacturer instructions.
5. Fastening schedule are as follows: For Simpson strap anchors, side nailing 2 – 10d x 1 1/2 and 4 – 10d x 1 1/2 nail in top of plate (total). For Hutch strap anchor STA16 (6)10d on each side (12 total). For Hutch strap anchor STA 18 (4)10d each side (8 total).

Note: It is the responsibility of the permit holder to install the anchors in accordance with the manufacturer requirements. The

above fasteners are approved alternates in Mecklenburg County. Should you wish to use another manufacturers' anchor, you will need to provide the manufacturers' installation instructions.

FRAMING

1. When is a framing inspection required?

NCACP Section 107.1.5 Framing inspections shall be made after the roof, walls, ceiling and floor framing is complete with appropriate blocking, bracing and fire stopping in place. The following Items must be in place and be visible for inspection:

- a) Pipes; to check for notching, boring or other penetrations.
- b) Chimneys and vents; to check for clearances from combustibles, fire stopping and proper construction.
- c) Windows & doors, flashing for roofs, chimneys and wall openings.
- d) Insulation baffles; may be required during framing inspection when insulating a cathedral ceiling and the 1" air space required between insulation and the roof deck is questionable.
- e) All lintels that are required to be bolted to the framing for support shall not be covered by any exterior or interior wall or ceiling finish material before approval. Work may continue without approval for lintels supported on masonry or concrete.
- f) Trade rough-ins complete.
- g) House wrap installed.

2. Can a bathroom exhaust fan be vented to the soffit vent?

Section R303.3 Bathrooms, water closet compartments and other similar rooms shall be provided with aggregate glazing area in windows of not less than 3 square feet, one-half of which must be openable.

Exception: The glazed areas shall not be required where artificial light and a mechanical *ventilation* system are provided. The minimum *ventilation* rates shall be determined in accordance with Section M1507 (50 cfm for intermittent *ventilation* or 20 cfm for continuous *ventilation*). *Ventilation* air from the space shall be exhausted directly to the outside.

3. **What is the minimum tread depth on a straight flight of stairs?**

Section R311.7.5.2 The minimum tread depth shall be 9 inches. The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch. Winder treads shall have a minimum tread depth of 9 inches measured at a point out 12 inches from the side where the treads are narrower. Winder treads shall have a minimum tread depth of 4 inches at any point. Within any flight of stairs, the greatest winder tread depth at the 12-inch walkline shall not exceed the smallest by more than $\frac{3}{8}$ inch.

4. **What are the minimum exit requirements?**

Section R311.2 **Egress door.** At least one exterior egress door shall be provided for each dwelling unit. The egress door shall be side-hinged and shall provide a minimum clear width of 32 inches when measured between the face of the door and the stop, with the door open 90 degrees. The clear height of the door opening shall not be less than 78 inches in height measured from the top of the threshold to the bottom of the stop. Other exterior doors shall not be required to comply with these minimum dimensions. Egress doors shall be readily openable from inside the dwelling without the use of a key or special knowledge or effort. All interior doors providing egress from habitable rooms shall have nominal dimensions of 2 ft. 6 in. width by 6 ft. 8 in. height and readily openable from the side from which egress is to be made without the use of a key or special knowledge or effort.

Section R310.1 Basements, habitable attics and every sleeping room shall have at least one operable emergency escape and rescue opening. Where basements contain one or more sleeping rooms, emergency egress and rescue openings shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way, or to a yard or court that opens to a public way. Where emergency escape and rescue openings are provided, they shall have a sill height of not more than 44 inches above the floor. Where

a door opening having a threshold below the adjacent ground elevation serves as an emergency escape and rescue opening and is provided with a bulkhead enclosure, the bulkhead enclosure shall comply with Section R310.3.2.

Section R310.3 Emergency escape and rescue openings with a finished sill height below the adjacent ground elevation shall be provided with a window well in accordance with Section R310.2.3.

Section R310.2.1 **Minimum opening area.** All emergency escape and rescue openings shall have a minimum net clear openable area of 4 square feet. The minimum net clear opening height shall be 22 inches. The minimum net clear opening width shall be 20 inches. Emergency escape and rescue openings must have a minimum total glazing area of not less than 5 square feet in the case of a ground floor level window and not less than 5.7 square feet in the case of an upper story window. The net clear opening dimensions required by this section shall be obtained by the normal operation of the emergency escape and rescue opening from the inside.

5. Does a wood column supporting a beam in a basement need to be attached?

Section R407.3 Yes. The columns shall be restrained to prevent lateral displacement at the top and bottom ends. Wood columns shall not be less in nominal size than 4 inches by 4 inches. Steel columns shall not be less than 3-inch-diameter Schedule 40 pipe manufactured in accordance with ASTM A 53 Grade B or *approved* equivalent.

Exception: In Seismic Design Categories A, B and C, columns no more than 48 inches in height on a pier or footing are exempt from the bottom end lateral displacement requirement within under-floor areas enclosed by a continuous foundation.

6. How much can a stud be notched or drilled?

Section R602.6 Notching - Any stud in an exterior wall or bearing partition may be cut or notched to a depth not exceeding 25 percent of its width. Studs in nonbearing partitions may be notched to a depth not to exceed 40 percent of a single stud width. Notching of bearing studs shall be on one edge only and not to exceed one-

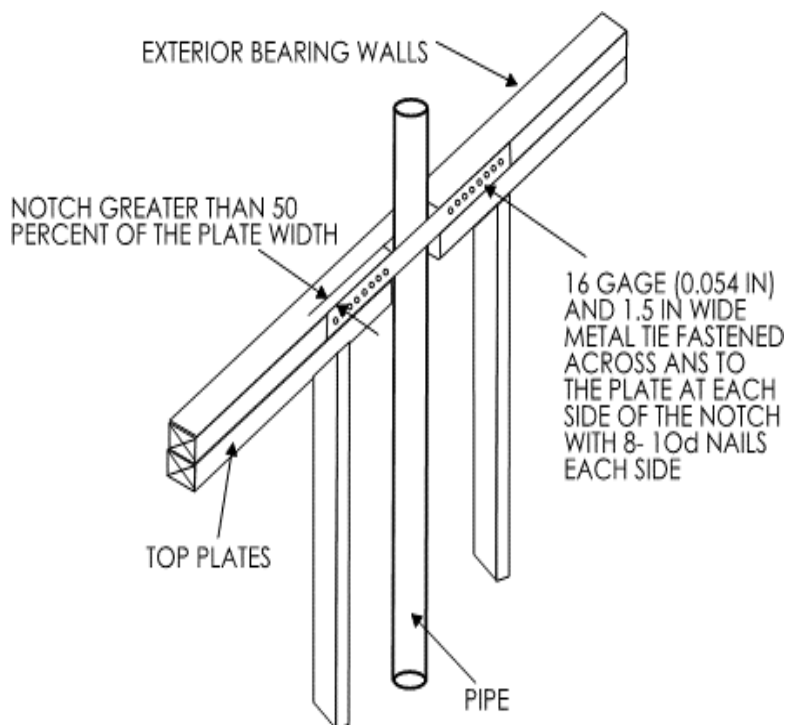
fourth the height of the stud. Notching shall not occur in the bottom or top 6 inches of the bearing studs.

Section R602.6 Drilling - Any single stud may be bored or drilled, provided that the diameter of the resulting hole is no more than 60 percent of the stud width, the edge of the hole is no more than 5/8 inch to the edge of the stud, and the hole shall not be closer than 6 inches from an adjacent hole or notch. Holes not exceeding 3/4 inch diameter can be as close as 1-1/2 inches on center spacing. Studs located in exterior walls or bearing partitions drilled over 40 percent and up to 60 percent shall also be doubled with no more than two successive doubled studs bored. See Figures R602.6(1) and R602.6(2).

7. How do I repair the top plates of an exterior wall when drilled OR notched?

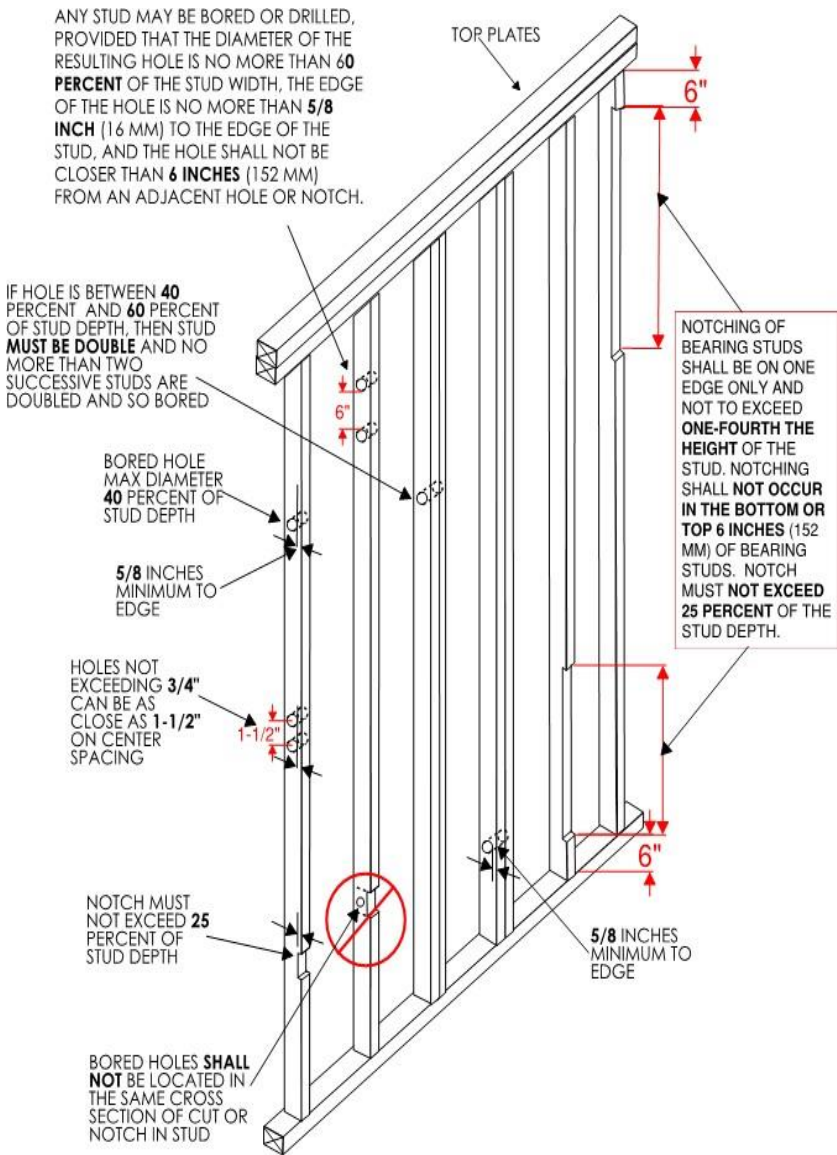
Section R602.6.1 Drilling and notching of top plate. When piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50 percent of its width, a galvanized metal tie not less than 0.054-inch-thick (16 ga.) and 1-1/2 inches wide shall be fastened across and to the plate at each side of the opening with not less than eight - 10d nails having a minimum length of 1-1/2 inches at each side or equivalent. The metal tie must extend a minimum of 6 inches past the opening. See Figure R602.6.1.

Exception: When the entire side of the wall with the notch or cut is covered by wood structural panel sheathing.



Source: 2018 NC State Residential Code

Figure R602.6.1 Top Plate Framing to Accommodate Piping



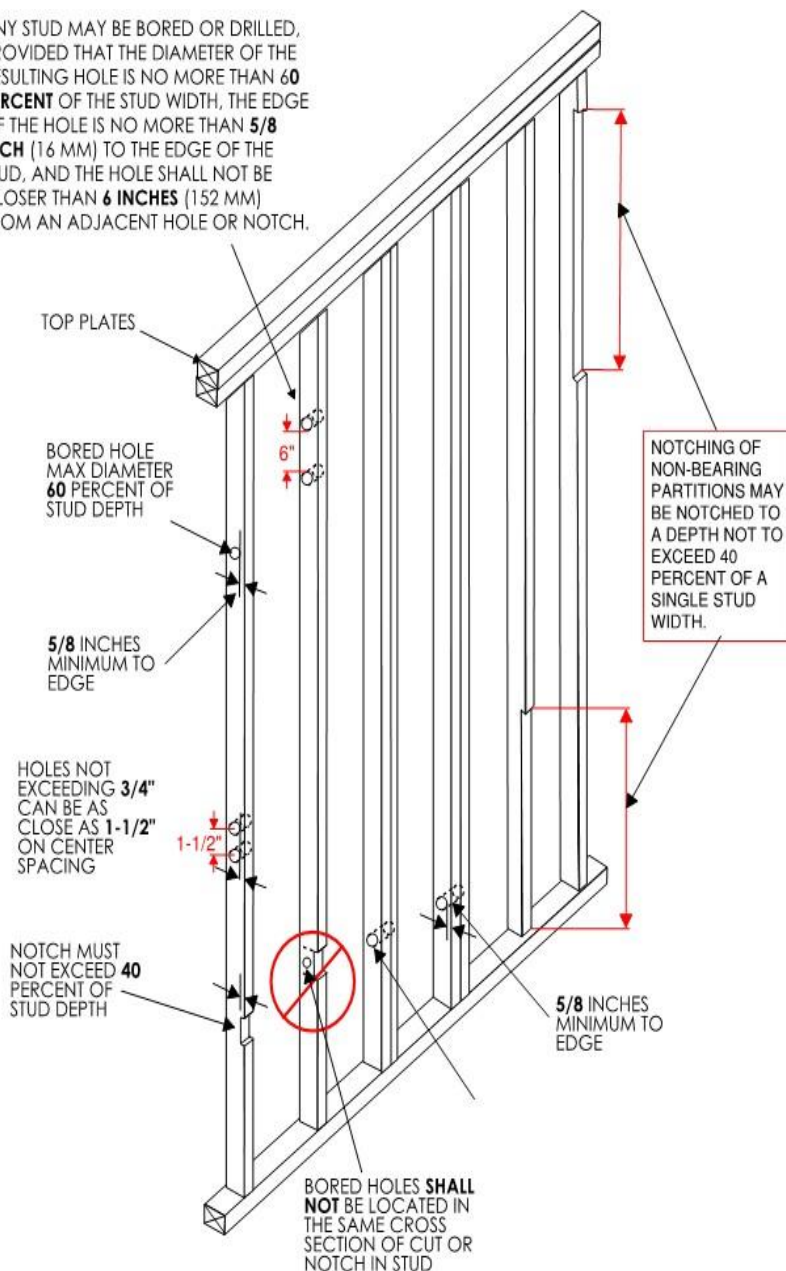
FOR SI: 1 INCH = 25.4mm

NOTE: CONDITION FOR EXTERIOR AND BEARING WALLS

Figure R602.6(1)
Notching & Bored Hole Limitations for Exterior Wall & Bearing Walls

Source: 2018 NC State Residential Code

ANY STUD MAY BE BORED OR DRILLED, PROVIDED THAT THE DIAMETER OF THE RESULTING HOLE IS NO MORE THAN **60 PERCENT** OF THE STUD WIDTH, THE EDGE OF THE HOLE IS NO MORE THAN **5/8 INCH** (16 MM) TO THE EDGE OF THE STUD, AND THE HOLE SHALL NOT BE CLOSER THAN **6 INCHES** (152 MM) FROM AN ADJACENT HOLE OR NOTCH.



FOR SI: 1 INCH = 25.4mm

Figure R602.6(2)

Notching & Bored Hole Limitations for Interior Nonbearing Walls

Source: 2018 NC State Residential Code

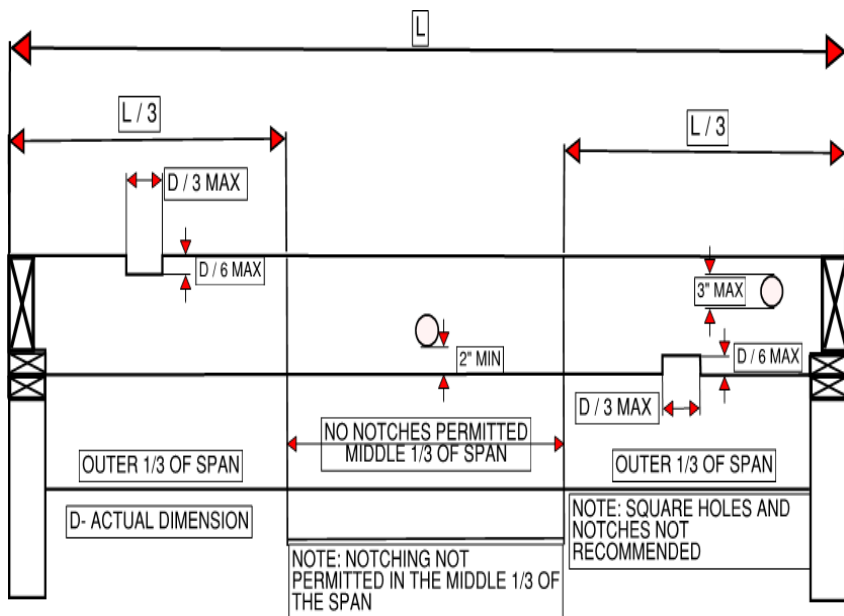
8. **The code requires a double floor joist under load-bearing partitions that run parallel to the joist. Can this double joist be separated to allow piping?**

Section R502.4 Yes. Joists under parallel bearing partitions shall be of adequate size to support the load. The code does allow the joists to be spaced apart to accommodate pipes, ducts, vents; however, the joists shall be full depth solid blocked with lumber not less than 2-inches in nominal thickness spaced not more than 4 feet on center.

9. **Can single, double, or triple floor joists, be drilled in the center third of the span?**

Section R502.8 There are restrictions on the size of the hole and where drilling is permitted. Structural floor members shall not be cut, bored, or notched in excess of the limitations specified. See table below and illustration on page 39.

LUMBER SIZES AND THEIR ALLOWANCES			
JOIST SIZE	MAX HOLE	MAX NOTCH DEPTH	MAX END NOTCH
2X4	NONE	NONE	NONE
2X6	1-1/2"	7/8"	1-3/8"
2X8	2-3/8"	1-1/4"	1-7/8"
2X10	3	1-1/2"	2-3/8
2X12	3-3/4"	1-7/8"	2-7/8"



Source: 2018 NC State Residential Code

10. Do electrical penetrations in exterior walls need to be fire blocked?

Section R602.8 Yes. Fire blocking shall be provided per section R302.11, to cut off all concealed draft openings (both vertical and horizontal) and to form an effective fire barrier between stories and between a top story and the roof space.

11. How much lateral bracing is required in exterior walls?

Section R602.10 Buildings, and portions thereof, shall be braced in accordance with one or more following sections using bracing materials and methods complying with Section R602.10.1 and load path detailing in accordance with Section R602.10.4.

12. When should the siding be attached to the exterior wall?

Section R701.2 Products sensitive to adverse weather shall not be installed until adequate weather protection for the installation is provided. Exterior sheathing shall be dry before applying exterior cover.

13. Where is flashing required on brick veneer finishes?

Section R703.8.5 Flashing of 6 mil poly or other corrosion-resistive material shall be located beneath the first course of masonry above finished ground level, above the foundation wall or slab, and at other points of support, including structural floors, shelf angles, and lintels when masonry veneer are designed in accordance with Section R703.8. Top of base flashing shall be installed with a minimum 2-inch lap behind building paper or water-repellent sheathing. See Section R703.4 for additional requirements.

14. Is bridging required at mid span of floor joists?

Section R502.7.1 Joists exceeding a nominal 2 inches by 12 inches shall be supported laterally by solid blocking, diagonal bridging (wood or metal), or a continuous 1-inch-by-3-inch strip nailed across the bottom of joists perpendicular to joists at intervals not exceeding 8 feet.

Exception: Trusses, structural composite lumber, structural glued-laminated members and I-joists shall be supported laterally as required by the manufacturer's recommendations.

15. The code requires hangers on the double trimmer joist at floor openings to support the header and/or girder when the member spans more than 6 feet. What is required when those members are less than 6 feet?

Section R502.10 Openings in floor framing shall be framed with a header and trimmer joists. When the header joist span does not exceed 4 feet, the header joist shall be a single member the same size as the floor joist. Single trimmer joists shall be used to carry a single header joist that is located within 3 feet of the trimmer joist bearing. When the header joist span exceeds 4 feet, the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the floor joists framing into the header. *Approved* hangers shall be used for the header joist to trimmer joist connections when the header joist span exceeds 6 feet. Hangers or ledgers are required for header joist spans. Tail joists over 12 feet long shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches.

16. In the design of truss construction, what are the drilling and notching requirements?

Section R802.3.1 Truss members and components shall not be cut, notched, spliced or otherwise altered in any way without the approval of a registered design professional.

17. How can a roof be framed for a cathedral ceiling?

Section R802.3.1 When rafters are used to create a cathedral ceiling; one method would be to design a ridge beam with proper support at each end to carry the roof loads. These loads will have direct bearing that is carried down to footings. Another method would be an engineered truss application for a roof system.

18. Can you explain Figure R802.5.1 braced rafter construction in the North Carolina State Residential Code?

Figure R802.5.1 This application needs to be used when the rafters are over spanned. Use the span tables R802.5.1(1) and R802.5.1(2) to check rafter spans. See Pages 64-68. Remember, span is always measured horizontally, not along rafter length.

The purlin or single ply header must be the same size as the rafter. The 2x4 down brace may have a maximum unbraced length of 8 feet, it must be laterally braced at mid-point or may be T-braced. See Illustration on page 68.

19. What roof pitch would not require underlayment?

Chapter 9 Roof Assemblies This chapter deals with several types of roof coverings. All roof covering would require an underlayment unless the manufacturer's instructions do not require one.

20. Can the underlayment be installed running up the pitch of the roof?

Section R905.1.1 No, underlayment shall be applied in accordance with Table R905.1.1(2). According to this section the underlayment shall be applied shingle fashion, parallel to and starting from the eave.

21. Which is the proper way to run the starter course for asphalt shingles?

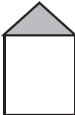



Section R905.2 Installation shall be installed per manufacturer's instructions. It is common for manufacturers to require you to cut the tabs off the ends of shingles, so the cement strip is located at the edge of the eaves. Check with manufacturer to assure proper installation.

22. Can a standard brick lintel be used at the fireplace opening?

Section R1001.7 Yes, as long as the lintel is non-combustible and capable of supporting imposed loads.

TABLE R602.3(5)
SIZE, HEIGHT AND SPACING OF WOOD STUDS ^{a, d}

Source: 2018 NC State Residential Code

STUD SIZES(INCHES)	<u>BEARING WALLS</u>					<u>NONBEARING WALLS</u>	
	LATERALLY UNSUPPORTED STUD HEIGHT ^a	MAXIMUM SPACING WHEN SUPPORTING A ROOF-CEILING ASSEMBLY OR A HABITABLE ATTICASSEMBLY, ONLY (INCHES)	MAXIMUM SPACING WHEN SUPPORTING ONE FLOOR, PLUS A ROOF-CEILING ASSEMBLY OR A HABITABLE ATTIC ASSEMBLY (INCHES)	MAXIMUM SPACING WHEN SUPPORTING TWO FLOORS, PLUS A ROOF-CEILING ASSEMBLY OR A HABITABLE ATTIC ASSEMBLY (INCHES)	MAXIMUM SPACING WHEN SUPPORTING ONE FLOOR HEIGHT ^a (FEET)	LATERALLY UNSUPPORTED STUD HEIGHT ^a (FEET)	MAXIMUM SPACING (INCHES)
							
2X3 ^b	---	---	---	---	---	10	16
2X4	10	24 ^c	16 ^c	---	24	14	24
3X4	10	24	24	16	24	14	24
2X5	10	24	24	---	24	16	24
2X6	10	24	24	16	24	20	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.093m².

- a. Listed heights are distances between points of lateral support placed perpendicular to the plan of the wall. Increases in unsupported height are permitted where justified by analysis.
- b. Shall not be used in exterior walls.
- c. A habitable attic assembly supported by 2x4 studs is limited to a roof span of 32 feet. Where the roof span exceeds 32 feet, the wall studs shall be increased to 2x6 or the studs shall be designed in accordance with accepted engineering practice.
- d. One half of the studs interrupted by a wall opening shall be

placed immediately outside the jack studs on each side of the opening as king studs to resist wind loads. King studs shall extend full height from sole plate to top plate of the wall.

TABLE R602.3(1) – WALL FRAMING ^{a, e, f}

Source: 2018 NC State Residential Code


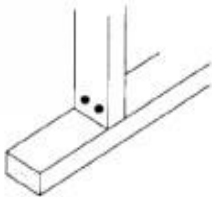

CONNECTION^b (NAIL SIZE AND POSITION) EXAGGERATED FOR ILLUSTRATIVE PURPOSES	FASTENER MINIMUM NOMINAL LENGTH IN INCHES x MINIMUM NOMINAL NAIL DIAMETER IN INCHES	QUANTITY PER CONNECTION, OR SPACING BETWEEN FASTENERS^d
Top or sole plate to stud (face nail) 	3-1/2" x 0.162" nail (16d common) ^c	<u>2</u>
	3" x 0.148" nail (10d common)	<u>3</u>
	3-1/4" x 0.131" nail	
	3" x 0.131" nail	
	3-1/4" x 0.120" nail	<u>4</u>
	3" x 0.120" nail	
Stud to top or sole plate (toe nail) 	2-1/2" x 0.131" nail (8d common) ^c	<u>4</u>
	3-1/2" x 0.162" nail (16d common)	<u>3</u>
	3" x 0.148" nail (10d common)	<u>4</u>
	3-1/4" x 0.131" nail	
	3" x 0.131" nail	
	3-1/4" x 0.120" nail	
	3" x 0.120" nail	
	2-1/8" x 0.113" nail	<u>5</u>
	2" x 0.113" nail	
	2-1/4" x 0.105" nail	
	2-1/4" x 0.099" nail	
Cap/top plate laps and intersections 	3-1/2" x 0.162" nail (16d common) ^c	<u>2 each side of lap</u>
	3" x 0.148" nail	<u>3 EACH SIDE OF LAP</u>
	3-1/4" x 0.131" nail	
	3" x 0.131" nail	
	3-1/4" x 0.120" nail	
	3" x 0.120" nail	

TABLE R602.3(1) – WALL FRAMING a, e, f

Source: 2018 NC State Residential Code




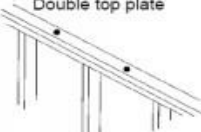

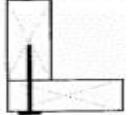
CONNECTION ^b (NAIL SIZE AND POSITION EXAGGERATED FOR ILLUSTRATIVE PURPOSES)	FASTENER MINIMUM NOMINAL LENGTH IN INCHES x MINIMUM NOMINAL NAIL DIAMETER IN INCHES	QUANTITY PER CONNECTION, OR SPACING BETWEEN FASTENERS ^d
Diagonal bracing 	<u>2-1/2" x 0.131" nail (8d common)^c</u>	<u>2</u>
	<u>3-1/2" x 0.162" nail (16d common)</u>	
	<u>3" x 0.148" nail (10d common)</u>	
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	<u>3</u>
	<u>3-1/4" x 0.120" nail</u>	
	<u>3" x 0.120" nail</u>	
	<u>2-1/8" x 0.113" nail</u>	
	<u>2" x 0.113" nail</u>	<u>4</u>
	<u>2-1/4" x 0.105" nail</u>	
	<u>2-1/4" x 0.099" nail</u>	
Sole plate to joist or blocking at braced panels 	<u>3-1/2" x 0.135" nail (16d common)</u>	<u>3 Per 16" Space</u>
	<u>3-1/2" x 0.162" nail (16d common)</u>	<u>2 Per 16" Space</u>
	<u>3" x 0.148" nail (10d common)</u>	<u>3 PER 16" SPACE</u>
	<u>3-1/4" x 0.131" nail</u>	<u>4 PER 16" SPACE</u>
	<u>3" x 0.131" nail</u>	
	<u>3-1/4" x 0.120" nail</u>	
Sole plate to joist or blocking 	<u>3" x 0.120" nail</u>	<u>16" o.c.</u>
	<u>3-1/2" x 0.162" nail (16d common)^c</u>	
	<u>3" x 0.148" nail (10d common)</u>	
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	
	<u>3-1/4" x 0.120" nail</u>	
Double top plate 	<u>3" x 0.148" nail (10d common)^c</u>	<u>16" o.c.</u>
	<u>3-1/2" x 0.162" nail (16d common)</u>	<u>12" o.c.</u>
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	
	<u>3-1/4" x 0.120" nail</u>	
	<u>3" x 0.120" nail</u>	
Double Studs 	<u>3" x 0.148" nail (10d common)^c</u>	<u>12" o.c.</u>
	<u>3-1/2" x 0.162" nail (16d common)</u>	<u>8" o.c.</u>
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	
	<u>3-1/4" x 0.120" nail</u>	
	<u>3" x 0.120" nail</u>	
Corner Studs 	<u>3-1/2" x 0.162" nail (16d common)</u>	<u>24" o.c.</u>
	<u>3" x 0.148" nail (10d common)</u>	<u>16" o.c.</u>
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	
	<u>3-1/4" x 0.120" nail</u>	<u>12" o.c.</u>
	<u>3" x 0.120" nail</u>	

TABLE R602.3(1) – CEILING & ROOF FRAMING ^{a, e}

Source: 2018 NC State Residential Code

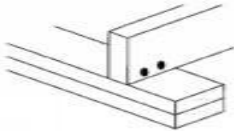
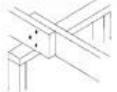


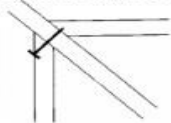
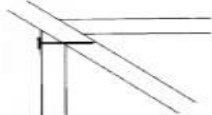
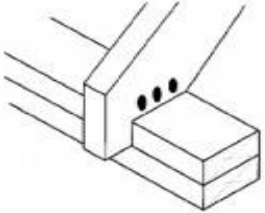
CONNECTION^a (NAIL SIZE AND POSITION EXAGGERATED FOR ILLUSTRATIVE PURPOSES)	FASTENER MINIMUM NOMINAL LENGTH IN INCHES x MINIMUM NOMINAL NAIL DIAMETER IN INCHES	QUANTITY PER CONNECTION, OR SPACING BETWEEN FASTENERS
Ceiling joist to plate 	<u>3-1/2" x 0.162" nail (16d common)</u> ^c	<u>3</u>
	<u>3" x 0.148" nail (10d common)</u>	<u>4</u>
	<u>3-1/4" x 0.131" nail</u>	<u>5</u>
	<u>3" x 0.131" nail</u>	
	<u>3-1/4" x 0.120" nail</u>	
	<u>3" x 0.120" nail</u>	
<div> <div> Ceiling joists, laps over partitions  </div> <div> Ceiling joist to parallel rafter  </div> </div>	<u>3-1/2" x 0.162" nail (16d common)</u> ^c	<u>3</u>
	<u>3" x 0.148" nail (10d common)</u>	<u>4</u>
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	
	<u>3-1/4" x 0.120" nail</u>	
	<u>3" x 0.120" nail</u>	
Collar tie to rafter 	<u>3" x 0.148" nail (10d common)</u>	<u>3</u>
	<u>3-1/2" x 0.162" nail (16d common)</u> ^c	<u>4</u>
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	
	<u>3-1/4" x 0.120" nail</u>	
	<u>3" x 0.120" nail</u>	
Jack rafter to hip, toe-nailed 	<u>3" x 0.148" nail (10d common)</u>	<u>3</u>
	<u>3-1/2" x 0.162" nail (16d common)</u> ^c	<u>4</u>
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	
	<u>3-1/4" x 0.120" nail</u>	
	<u>3" x 0.120" nail</u>	
Jack rafter to hip, face nailed 	<u>3-1/2" x 0.162" nail (16d common)</u>	<u>2</u>
	<u>3" x 0.148" nail (10d common)</u>	<u>3</u>
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	<u>4</u>
	<u>3-1/4" x 0.120" nail</u>	
	<u>3" x 0.120" nail</u>	
Roof rafter to plate (toe-nailed) 	<u>2-1/2" x 0.131" nail (8d common)</u> ^c	<u>3</u>
	<u>3-1/2" x 0.162" nail (16d common)</u>	
	<u>3" x 0.148" nail (10d common)</u>	
	<u>3-1/4" x 0.131" nail</u>	
	<u>3" x 0.131" nail</u>	<u>4</u>
	<u>3-1/4" x 0.120" nail</u>	
	<u>3" x 0.120" nail</u>	
	<u>2-3/8" x 0.113" nail</u>	<u>5</u>
	<u>2" x 0.113" nail</u>	
	<u>2-1/4" x 0.105" nail</u>	<u>6</u>
	<u>2-1/4" x 0.099" nail</u>	<u>6</u>

TABLE R602.3(1) – CEILING & ROOF FRAMING ^{a, e}

Source: 2018 NC State Residential Code

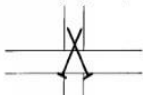
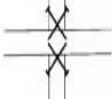
CONNECTION^a (NAIL SIZE AND POSITION EXAGGERATED FOR ILLUSTRATIVE PURPOSES)	FASTENER MINIMUM NOMINAL LENGTH IN INCHES x MINIMUM NOMINAL NAIL DIAMETER IN INCHES	QUANTITY PER CONNECTION, OR SPACING BETWEEN FASTENERS
Roof rafter to 2-by ridge beam, face nailed  (only the attachment of the top rafter is illustrated)	3-1/2" x 0.162" nail (16d common) ^c	<u>2</u>
	3" x 0.148" nail (10d common)	<u>3</u>
	3-1/4" x 0.131" nail	
	3" x 0.131" nail	
	3-1/4" x 0.120" nail	<u>4</u>
Roof rafter to 2-by ridge beam, toe-nailed 	3-1/2" x 0.162" nail (16d common) ^c	<u>2</u>
	3" x 0.148" nail (10d common)	<u>3</u>
	3-1/4" x 0.131" nail	
	3" x 0.131" nail	
	3-1/4" x 0.120" nail	<u>4</u>
	3" x 0.120" nail	<u>4</u>

TABLE R602.3(1) – FLOOR FRAMING ^{a, e}

Source: 2018 NC State Residential Code

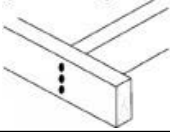
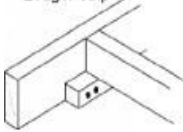
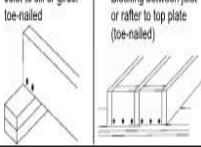


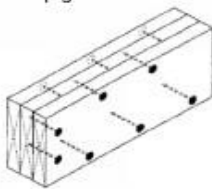
CONNECTION^a (NAIL SIZE AND POSITION EXAGGERATED FOR ILLUSTRATIVE PURPOSES)	FASTENER MINIMUM NOMINAL LENGTH IN INCHES x MINIMUM NOMINAL NAIL DIAMETER IN INCHES	QUANTITY PER CONNECTION, OR SPACING BETWEEN FASTENERS
joist to band joist 	3-1/2" x 0.162" nail (16d common) ^c	<u>3</u>
	3" x 0.148" nail (10d common)	<u>5</u>
	3-1/4" x 0.131" nail	
	3" x 0.131" nail	
	3-1/4" x 0.120" nail	<u>6</u>
Ledger strip 	3-1/2" x 0.162" nail (16d common) ^c	<u>3</u>
	3" x 0.148" nail (10d common)	<u>4</u>
	3-1/4" x 0.131" nail	
	3" x 0.131" nail	
	3-1/4" x 0.120" nail	
Joist to sill or girder toe-nailed Blocking between joist or rafter to top plate (toe-nailed) 	2-1/2" x 0.131" nail (8d common) ^c	<u>3</u>
	3" x 0.148" nail (10d common)	
	3-1/4" x 0.131" nail	
	3" x 0.131" nail	<u>4</u>
	3-1/4" x 0.120" nail	
Bridging to joist (listed number of fasteners at each end) 	3" x 0.120" nail	<u>3</u>
	2-1/8" x 0.113" nail	
	2" x 0.113" nail (6d common)	<u>4</u>
	2-1/4" x 0.105" nail	<u>3</u>
	2-1/4" x 0.099" nail	<u>4</u>

TABLE R602.3(1) – FLOOR FRAMING a, e

Source: 2018 NC State Residential Code

<u>CONNECTION^b (NAIL SIZE AND POSITION EXAGGERATED FOR ILLUSTRATIVE PURPOSES)</u>	<u>FASTENER MINIMUM NOMINAL LENGTH IN INCHES x MINIMUM NOMINAL NAIL DIAMETER IN INCHES</u>	<u>QUANTITY PER CONNECTION, OR SPACING BETWEEN FASTENERS</u>
<p>Rim joist to top plate (toe-nailed)</p> 	2-1/2" x 0.113" (3d box) ^c	4" o.c.
	3-1/2" x 0.162" nail (16d common)	8" o.c.
	3" x 0.148" nail (10d common)	6" o.c.
	3-1/4" x 0.131" nail	
	3" x 0.131" nail	
	3-1/4" x 0.120" nail	4" o.c.
	3" x 0.120" nail	4" o.c.
	2-1/8" x 0.113" nail	4" o.c.
	2" x 0.113" nail (6d common)	3" o.c.
	2-1/4" x 0.105" nail	
	2-1/4" x 0.099" nail	

<u>CONNECTION^b (NAIL SIZE AND POSITION EXAGGERATED FOR ILLUSTRATIVE PURPOSES)</u>	<u>FASTENER MINIMUM NOMINAL LENGTH IN INCHES x MINIMUM NOMINAL NAIL DIAMETER IN INCHES</u>	<u>SPACING OF FASTENERS ALONG THE TOP AND BOTTOM OF BEAM, STAGGERED ON EACH SIDE OF EACH LAYER</u>	<u>NUMBER OF FASTENERS AT EACH END AND SPLICE FOR EACH LAYER</u>
<p>Built-up girders and beams</p> 	4" x 0.192" nail (20d common) ^c	32" o.c.	2
	3-1/2" x 0.162" nail (16d common)	24" o.c.	3
	3" x 0.148" nail (10d common)		
	3-1/4" x 0.131" nail		
	3" x 0.131" nail	16" o.c.	3
	3-1/4" x 0.120" nail		
	3" x 0.120" nail	16" o.c.	4
	2-1/2" x 0.131" nail (8d common)		

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.44 m/s, 1 foot = 304.8 mm.

- This fastening schedule applies to framing members having an actual thickness of 1-1/2" (nominal "2-by" lumber).
- Fastenings listed above may also be used for other connections that are not listed but that have the same configuration and the same code requirement for fastener quantity/spacing and fastener size (pennyweight and style, e.g., 8d common, "8-penny common nail").
- This fastener, in the quantity or spacing shown in the rightmost column, comprises the most stringent fastening of the connection listed in the *International Residential Code*.
- Fastening schedule only applies to buildings of conventional

wood frame construction where wind or seismic analysis is not required by the applicable code. In areas where wind or seismic analysis is required, required fastening must be determined by structural analysis. The following are conditions for which codes require structural analysis:

- i. For nominal dimensions of nails see Table R602.3(1a)
- ii. *North Carolina Residential Code* – buildings located in areas where the design wind speed equals or exceeds 130 mph (58 m/s) or townhouses assigned to seismic design categories C.
- e. Reprinted by permission of the ICC Evaluation Service, LLC from Evaluation Report ESR-1539. Use of ESR 1539-15 is permitted
- f. Nails and staples shall conform to the requirements of ASTM F1667

TABLE R602.3(1) – FASTENER SCHEDULE FOR STRUCTURAL MEMBERS ^{j, k}

Source: 2018 NC State Residential Code

DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENERS ^{b, c, e}	SPACING OF FASTENERS	
		Edges (inches) ⁱ	Intermediate supports ^{c, e} (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particle board wall sheathing to framing			
3/8" - 1/2 "	6d common (2" × 0.113") nail (subfloor wall) 8d common (2-1/2" × 0.131") nail (roof) ^f	6	12 ^g
19/32"- 1"	8d common nail (2-1/2" × 0.131")	6	12 ^g
1-1/8" - 1-1/4"	10d common (3" × 0.148") nail or 8d (2-1/2" × 0.131") deformed nail	6	12
Other wall sheathing ^h			
1/2" structural cellulosic fiberboard sheathing	1-1/2" galvanized roofing nail, 7/16" crown or 1" crown staple 16 ga., 1-1/4" long	3	6
25/32" structural cellulosic fiberboard sheathing	1-3/4" galvanized roofing nail, 7/16" crown or 1" crown staple 16 ga., 1-1/2" long	3	6
1/2" gypsum sheathing ^d	1-1/2" galvanized roofing nail, staple galvanized, 1-1/2" long; 1-1/4" screws, Type W or S	7	7
5/8" gypsum sheathing ^d	1-3/4" galvanized roofing nail, staple galvanized, 1-5/8" long; 1-5/8" screws, Type W or S	7	7

TABLE R602.3(1) – FASTENER SCHEDULE FOR STRUCTURAL MEMBERS^{j, k}

Source: 2018 NC State Residential Code

DESCRIPTION OF BUILDING MATERIALS	DESCRIPTION OF FASTENERS ^{b, c, e}	SPACING OF FASTENERS	
		Edges (inches) ⁱ	Intermediate supports ^{c, e} (inches)
Wood structural panels, combination subfloor underlayment to framing			
3/4" and less	6d deformed (2" × 0.120") nail or 8d common (2-1/2" × 0.131") nail	6	12
7/8" – 1"	8d common (2-1/2" × 0.131") nail or 8d deformed (2-1/2" × 0.120") nail	6	12
1-1/8" – 1-1/4"	10d common (3" × 0.148") nail or 8d deformed (2-1/2" × 0.120") nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1ksi = 6.895 MPa.

- a. Deleted.
- b. Staples are 16 gage wire and have a minimum 7/16-inch on diameter crown width.
- c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.
- d. Four-foot-by-8-foot or 4-foot-by-9-foot panels shall be applied vertically
- e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).
- f. For regions having ultimate wind speed of 130 mph or greater, 8d deformed (2 1/2" × 0.120") nails shall be used for attaching plywood and wood structural panel roof sheathing to framing within minimum 48- inch distance from gable end walls, if mean roof height is more than 25 feet, up to 35 feet maximum.
- g. For regions having ultimate wind speed of 120 mph or less, nails for attaching wood structural panel roof sheathing to gable end wall framing shall be spaced 6 inches on center. When basic wind speed is greater than 100 mph, nails for attaching panel roof sheathing to intermediate supports shall be spaced 6 inches on center for minimum 48-inch distance from ridges, eaves and gable end walls; and 4 inches on center to gable end wall framing.
- h. Gypsum sheathing shall conform to ASTM C 79 and shall be installed in accordance with GA 253. Fiberboard sheathing shall conform to ASTM C 208.
- i. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at all floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid

blocking. Roof sheathing 7/16- inch or greater in thickness does not require perimeter blocking.

j. For nominal dimensions of nails see Table R602.3(1a).

k. Nails and staples shall conform to the requirements of ASTM F1667

TABLE R602.3(2)ⁱ – ALTERNATE ATTACHMENTS TO TABLE R602.3(1)

Source: 2018 NC State Residential Code

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a, b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches) ⁱ	Intermediate supports (inches)
Wood structural panels, subfloor, roof ^a and wall sheathing to framing and particleboard wall sheathing to framing ^f			
up to 1/2"	Staple 15 ga. 1-3/4"	4	8
	0.097 - 0.099 Nail 2-1/4"	3	6
	Staple 16 ga. 1-3/4"	3	6
19/32" and 5/8"	0.113 Nail 2"	3	6
	Staple 15 and 16 ga. 2"	4	8
	0.097 - 0.099 Nail 2-1/4"	4	8
23/32" and 3/4"	Staple 14 ga. 2"	4	8
	Staple 15 ga. 1-3/4"	3	6
	0.097 - 0.099 Nail 2-1/4"	4	8
	Staple 16 ga. 2"	4	8
1"	Staple 14 ga. 2-1/4"	4	8
	0.113 Nail 2-1/4"	3	6
	Staple 15 ga. 2-1/4"	4	8
	0.097 - 0.099 Nail 2-1/2'	4	8
NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a, b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches) ⁱ	Body of panel ^d (inches)
Floor underlayment; plywood-hardboard-particleboard ^f - fiber-cement ^h			
Fiber-cement			
1/4	3d, corrosion-resistant, ring shank nails (finished flooring other than tile)	3	6
	Staple 18 ga., 7/8 long, ¼ crown (finished flooring other than tile)	3	6
	1-1/4 long x 0.121 shank x 0.375 head diameter corrosion-resistant (galvanized or stainless steel) roofing nails (for tile finish)	8	8
	1-1/4 long, No. 8 x 0.375 head diameter, ribbed wafer-head screws (for tile finish)	8	8
PLYWOOD			
1/4" and 5/16"	1-1/4" ring or screw shank nail-minimum	3	6
	12- 1/2 ga. (0.099") shank diameter		
	Staple 18 ga., 7/8, 3/16 crown width	2	5
11/32", 3/8", 15/32", and 1/2"	1-1/4" ring or screw shank nail-minimum 12- 1/2 ga. (0.099") shank diameter	6	8 ^e
19/32", 5/8", 23/32" and 3/4"	1-1/2" ring or screw shank nail-minimum	6	8
	12- 1/2 ga. (0.099") shank diameter		
	Staple 16 ga. 1-1/2"	6	8

**TABLE R602.3(2)ⁱ – ALTERNATE ATTACHMENTS TO TABLE
R602.3(1)**

Source: 2018 NC State Residential Code

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a, b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches) ⁱ	Body of panel ^d (inches)
Floor underlayment; plywood-hardboard-particleboard ^f - fiber-cement ^h			
Hardboard ^f			
0.200	1-1/2" long ring-grooved underlayment nail	6	6
	4d cement-coated sinker nail	6	6
	Staple 18 ga., 7/8" long (plastic coated)	3	6
Particleboard			
¼	4d ring-grooved underlayment nail	3	6
	Staple 18 ga., 7/8" long, 3/16" crown	3	6
3/8	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1-1/8" long, 3/8" crown	3	6
½, 5/8	6d ring-grooved underlayment nail	6	10
	Staple 16 ga., 1-5/8" long, 3/8" crown	3	6

For SI: 1 inch = 25.4 mm.

- a. Nail is a general description and shall be permitted to be T-head, modified round head or round head.
- b. Staples shall have a minimum crown width of 7/16-inch on diameter except as noted.
- c. Nails or staples shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater. Nails or staples shall be spaced at not more than 12 inches on center at intermediate supports for floors.
- d. Fasteners shall be placed in a grid pattern throughout the body of the panel.
- e. For 5-ply panels, intermediate nails shall be spaced not more than 12 inches on center each way.
- f. Hardboard underlayment shall conform to CPA/AMSI A135.4.
- g. Specified alternate attachments for roof sheathing shall be permitted where the ultimate design wind speed is less than 130 mph. fasteners attaching wood structural panel roof sheathing to gable end wall framing shall be installed using the spacing listed for panel edges.
- h. Fiber-cement underlayment shall conform to ASTM C1288 or ISO 8336, Category C.
- i. Nails and staples shall conform to the requirements of ASTM F1667.

TABLE R602.7(1) #1 SYP OR BETTER

GIRDER SPANS ^{a, b} AND HEADER SPANS ^{a, b} FOR EXTERIOR BEARING WALLS

(Max. spans for Doug. fir-larch, hem-fir, southern pine and spruce-pine-fir ^b and required # of jack studs)

Source: 2018 NC State Residential Code

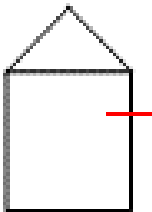
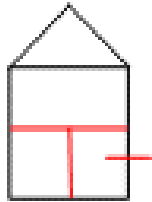
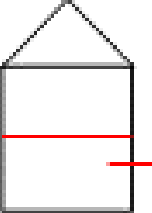
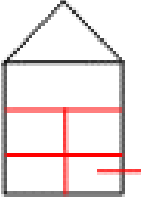
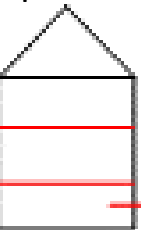
GIRDER AND HEADER SUPPORTS	SIZE	GROUND SNOW LOAD (psf) ^e					
		30					
		Building With ^c Feet					
		20		28		36	
		Span	NJ ^d	Span	NJ ^d	Span	NJ ^d
Roof and ceiling 	2-2x4	3-6	1	3-2	1	2-10	1
	2-2x6	5-5	1	4-8	1	4-2	1
	2-2x8	6-10	1	5-11	2	5-4	2
	2-2x10	8-5	2	7-3	2	6-6	2
	2-2x12	9-9	2	8-5	2	7-6	2
	3-2x8	8-4	1	7-5	1	6-8	1
	3-2x10	10-6	1	9-1	2	8-2	2
	3-2x12	12-2	2	10-7	2	9-5	2
	4-2x8	9-2	1	8-4	1	7-8	1
	4-2x10	11-8	1	10-6	1	9-5	2
	4-2x12	14-1	1	12-2	2	2-10	2
Roof, ceiling and one center bearing floor 	2-2x4	3-1	1	2-9	1	2-5	1
	2-2x6	4-6	1	4-0	1	3-7	2
	2-2x8	5-9	2	5-0	2	4-6	2
	2-2x10	7-0	2	6-2	2	5-6	2
	2-2x12	8-1	2	7-1	2	6-5	2
	3-2x8	7-2	1	6-3	2	5-8	2
	3-2x10	8-9	2	7-8	2	6-11	2
	3-2x12	10-2	2	8-11	2	8-0	2
	4-2x8	8-1	1	5-2	2	4-8	2
	4-2x10	10-1	1	8-10	2	8-0	2
	4-2x12	11-9	2	10-3	2	9-3	2
Roof, ceiling and one clear span floor 	2-2x4	2-8	1	2-4	1	2-1	1
	2-2x6	3-11	1	3-5	2	3-0	2
	2-2x8	5-0	2	4-4	2	3-10	2
	2-2x10	6-1	2	5-3	2	4-8	2
	2-2x12	7-1	2	6-1	3	5-5	3
	3-2x8	6-3	2	5-5	2	4-10	2
	3-2x10	7-7	2	6-7	2	5-11	2
	3-2x12	8-10	2	7-8	2	6-10	2
	4-2x8	7-2	1	6-3	2	5-7	2
	4-2x10	8-9	2	7-7	2	6-10	2
	4-2x12	10-2	2	7-10	2	7-11	2

TABLE R602.7(1)

GIRDER SPANS ^{a, b} AND HEADER SPANS ^{a, b} FOR EXTERIOR BEARING WALLS

(Max. spans for Doug. fir-larch, hem-fir, southern pine and spruce-pine-fir ^b and required # of jack studs)

Source: 2018 NC State Residential Code

GIRDER AND HEADER SUPPORTS	SIZE	GROUND SNOW LOAD (psf) ^e					
		30					
		Building With ^c Feet					
		20		28		36	
		Span	NJ ^d	Span	NJ ^d	Span	NJ ^d
Roof, ceiling and two center bearing floors 	2-2x4	2-7	1	2-3	1	2-0	1
	2-2x6	3-9	2	3-3	2	2-11	2
	2-2x8	4-9	2	4-2	2	3-9	2
	2-2x10	5-9	2	5-1	2	4-7	3
	2-2x12	6-8	2	5-10	3	5-3	3
	3-2x8	5-11	2	5-2	2	4-8	2
	3-2x10	7-3	2	6-4	2	5-8	2
	3-2x12	8-5	2	7-4	2	6-7	2
	4-2x8	4-10	2	4-3	2	3-10	2
	4-2x10	8-4	2	7-4	2	6-7	2
	4-2x12	9-8	2	8-6	2	7-8	2
Roof, ceiling and two clear span floors 	2-2x4	2-1	1	1-8	1	1-6	2
	2-2x6	3-1	2	2-8	2	2-4	2
	2-2x8	3-10	2	3-4	2	3-0	3
	2-2x10	4-9	2	4-1	3	3-8	3
	2-2x12	5-6	3	4-9	3	4-3	3
	3-2x8	4-10	2	4-2	2	3-9	2
	3-2x10	5-11	2	5-1	2	4-7	3
	3-2x12	6-10	2	5-11	3	5-4	3
	4-2x8	5-7	2	4-10	2	4-4	2
	4-2x10	6-10	2	5-11	2	5-3	2
	4-2x12	7-11	2	6-10	2	6-2	3

FOR SI" 1" = 25.4 MM, 1 POUND PER SQ FT=0.0479 kPa

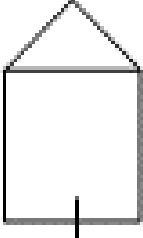
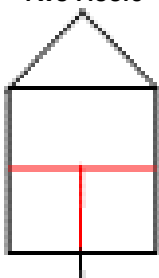
- Spans are given in feet and inches.
- No 1 or better grade lumber shall be used for southern pine.** Other tabulated values assume #2 grade lumber.
- Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
- NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.
- Use 30psf ground snow load for cases in which ground snow load is less than 30psf and the roof live load is equal to or less than 20psf.

TABLE R602.7(2)

GIRDER SPANS ^{a, b} AND HEADER SPANS ^{a, b} FOR INTERIOR BEARING WALLS

(Max. spans for Doug. fir-larch, hem-fir, southern pine and spruce-pine-fir ^b and required # of jack studs)

Source: 2018 NC State Residential Code

GIRDER AND HEADER SUPPORTS	SIZE	GROUND SNOW LOAD (psf) ^e					
		30					
		Building With ^c Feet					
		20		28		36	
		Span	NJ ^d	Span	NJ ^d	Span	NJ ^d
One Floor Only 	2-2x4	3-1	1	2-8	1	2-5	1
	2-2x6	4-6	1	3-11	1	3-6	1
	2-2x8	5-9	1	5-0	2	4-5	2
	2-2x10	7-0	2	6-1	2	5-5	2
	2-2x12	8-1	2	7-0	2	6-3	2
	3-2x8	7-2	1	6-3	1	5-7	2
	3-2x10	8-9	1	7-7	2	6-9	2
	3-2x12	10-2	2	8-10	2	7-10	2
	4-2x8	9-0	1	7-8	1	6-9	1
	4-2x10	10-1	1	8-9	1	7-10	2
	4-2x12	11-9	1	10-2	2	9-1	2
Two Floors 	2-2x4	2-2	1	1-10	1	1-7	1
	2-2x6	3-2	2	2-9	2	2-5	2
	2-2x8	4-1	2	3-6	2	3-2	2
	2-2x10	4-11	2	4-3	2	3-10	3
	2-2x12	5-9	2	5-0	3	4-5	3
	3-2x8	5-1	2	4-5	2	3-11	2
	3-2x10	6-2	2	5-4	2	4-10	2
	3-2x12	7-2	2	6-3	2	5-7	3
	4-2x8	6-1	1	5-3	2	4-8	2
	4-2x10	7-2	2	6-2	2	5-6	2
	4-2x12	8-4	2	7-2	2	6-5	2

FOR SI" 1" = 25.4 MM, 1 POUND PER SQ FT=0.0479 kPa

a. Spans are given in feet and inches.

b. **No 1 or better grade lumber shall be used for southern pine.**

Other tabulated values assume #2 grade lumber.

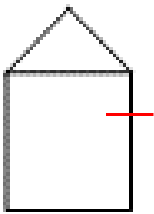
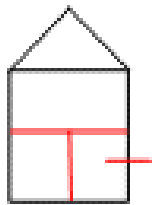
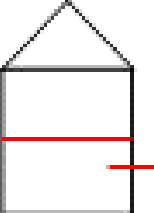
c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

Supplemental Table R602.7(1) #2 SYP
GIRDER SPANS AND HEADER SPANS FOR EXTERIOR BEARING
WALLS ^{a, b, c, d, e, f}

(Max. spans for #2 SOUTHERN YELLOW PINE and required # of jack studs)

Source: 2018 NC State Residential Code

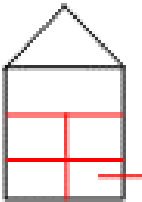
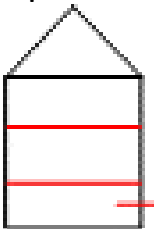
GIRDER AND HEADER SUPPORTS	SIZE	GROUND SNOW LOAD (psf) ^e					
		30					
		Building With ^c Feet					
		20		28		36	
		Span	NJ ^d	Span	NJ ^d	Span	NJ ^d
Roof and ceiling 	2-2x4	3-3	1	2-10	1	2-7	1
	2-2x6	4-9	1	4-2	1	3-9	1
	2-2x8	5-10	1	5-2	2	4-8	2
	2-2x10	6-6	2	5-9	2	5-3	2
	2-2x12	7-0	2	6-3	2	5-10	2
	3-2x8	7-0	1	6-2	1	5-7	1
	3-2x10	7-8	1	6-10	2	6-3	2
	3-2x12	8-2	2	7-4	2	6-9	2
	4-2x8	7-9	1	6-11	1	6-4	1
	4-2x10	8-6	1	7-8	1	7-0	2
	4-2x12	9-2	1	8-2	2	7-6	2
Roof, ceiling and one center bearing floor 	2-2x4	2-8	1	2-4	1	2-2	1
	2-2x6	4-0	1	3-6	1	3-2	2
	2-2x8	4-11	2	4-4	2	3-11	2
	2-2x10	5-7	2	5-0	2	4-7	2
	2-2x12	6-1	2	5-6	2	5-1	2
	3-2x8	5-11	1	5-3	2	4-10	2
	3-2x10	6-6	2	5-11	2	5-5	2
	3-2x12	7-1	2	6-5	2	6-0	2
	4-2x8	6-8	1	6-0	2	5-6	2
	4-2x10	7-4	1	6-7	2	6-1	2
	4-2x12	7-11	2	7-1	2	6-7	2
Roof, ceiling and one clear span floor 	2-2x4	2-5	1	2-1	1	1-10	1
	2-2x6	3-6	1	3-0	2	2-9	2
	2-2x8	4-5	2	3-10	2	3-6	2
	2-2x10	5-1	2	4-6	2	4-1	2
	2-2x12	5-7	2	5-0	3	4-7	3
	3-2x8	5-5	2	4-9	2	4-3	2
	3-2x10	6-0	2	5-5	2	4-11	2
	3-2x12	6-6	2	5-11	2	5-5	2
	4-2x8	6-1	1	5-5	2	4-11	2
	4-2x10	6-9	2	6-0	2	5-6	2
	4-2x12	7-3	2	6-6	2	6-0	2

Supplemental Table R602.7(1) #2 SYP

GIRDER SPANS AND HEADER SPANS FOR EXTERIOR BEARING WALLS ^{a, b, c, d, e, f}

(Max. spans for #2 SOUTHERN YELLOW PINE and required # of jack studs)

Source: 2018 NC State Residential Code

GIRDER AND HEADER SUPPORTS	SIZE	GROUND SNOW LOAD (psf) ^e					
		30					
		Building With ^c Feet					
		20		28		36	
		Span	NJ ^d	Span	NJ ^d	Span	NJ ^d
Roof, ceiling and two center bearing floors 	2-2x4	2-3	1	1-11	1	1-9	1
	2-2x6	3-4	1	2-11	1	2-8	1
	2-2x8	4-2	2	3-8	1	3-4	1
	2-2x10	4-9	2	4-3	2	3-11	1
	2-2x12	5-4	2	4-10	2	4-5	2
	3-2x8	5-1	2	4-6	2	4-1	2
	3-2x10	5-9	2	5-2	2	4-9	2
	3-2x12	6-3	2	5-8	2	5-3	2
	4-2x8	5-9	1	5-2	1	4-9	1
	4-2x10	6-5	2	5-9	1	5-4	1
Roof, ceiling and two clear span floors 	4-2x12	6-11	2	6-3	2	5-10	1
	2-2x4	1-10	2	1-6	2	1-4	2
	2-2x6	2-9	2	2-4	2	2-1	2
	2-2x8	3-5	2	3-0	2	2-8	2
	2-2x10	4-0	3	3-6	2	3-2	2
	2-2x12	4-7	3	4-0	3	3-8	2
	3-2x8	4-3	2	3-8	1	3-4	1
	3-2x10	4-11	2	4-3	2	3-10	1
	3-2x12	5-6	2	4-11	2	4-5	2
	4-2x8	7-11	2	4-3	2	3-10	1
	4-2x10	5-7	2	4-11	2	4-5	2
	4-2x12	6-2	3	5-6	2	5-0	2

FOR SI" 1" = 25.4 MM, 1 POUND PER SQ FT=0.0479 kPa

- a. Spans are given in feet and inches.
- b. **Spans are based on minimum design properties for No.2 Grade Lumber of southern pine only.** For other Species, See Table R602.7(1) 2018 NCRC
- c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
- d. NJ - Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.
- e. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.
- f. One half of the studs interrupted by a wall opening shall be placed immediately outside the jack studs on each side of the opening as king studs to resist wind loads. King studs shall extend full height from sole plate to top plate of the wall.

TABLE R502.3.1(1)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES

Residential sleeping area, live load = 30 psf. $L/\Delta = 360^a$

Source: 2018 NC State Residential Code

JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf			
		2x6	2x8	2x10	2x12
		Maximum floor joist spans			
		(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)
12	Southern pine SS	12-3	16-2	20-8	25-1
	Southern pine #1	11-10	15-7	19-10	24-2
	Southern pine #2	11-3	14-11	18-1	21-4
	Southern pine #3	9-2	11-6	14-0	16-6
	Spruce-pine- SS	11-7	15-3	19-5	23-7
	Spruce-pine- #1	11- 3	14-11	19- 0	23- 0
	Spruce-pine- #2	11- 3	14-11	19- 0	23- 0
16	Spruce-pine- #3	9- 8	12- 4	15- 0	17- 5
	Southern pine SS	11-2	14-8	18-9	22-10
	Southern pine #1	10- 9	14- 2	18- 0	21- 4
	Southern pine #2	10-3	13-3	15-8	18-6
	Southern pine #3	7-11	10-10	12-1	14-4
	Spruce-pine- SS	10-6	13-10	17-8	21-6
	Spruce-pine- #1	10-3	13-6	17-2	19-11
19.2	Spruce-pine- #2	10- 3	13- 6	17- 2	19-11
	Spruce-pine- #3	8- 5	10- 8	13- 0	15- 1
	Southern pine SS	10-6	13-10	17-8	21-6
	Southern pine #1	10-1	13-4	16-5	19-6
	Southern pine #2	9-6	12-1	14-4	16-10
	Southern pine #3	7-3	9-1	11-0	13-1
	Spruce-pine- SS	9-10	13-0	16-7	20-2
24	Spruce-pine- #1	9-8	12-9	15-8	18-3
	Spruce-pine- #2	9-8	12-9	15-8	18-3
	Spruce-pine- #3	7-8	9-9	11-10	13-9
	Southern pine SS	9-9	12-10	16-5	19-11
	Southern pine #1	9-4	12-4	14-8	17-5
	Southern pine #2	8-6	10-10	12-10	15-1
	Southern pine #3	6-5	8-2	9-10	11-8
	Spruce-pine- SS	9-2	12-1	15-5	18-9
	Spruce-pine- #1	8-11	11-6	14-1	16-3
	Spruce-pine- #2	8-11	11-6	14-1	16-3
	Spruce-pine- #3	6-10	8-8	10-7	12-4

FOR SI" 1" = 25.4 MM, 1 POUND PER SQ FT=0.0479 kPa

- a. Dead load limits for townhouses in Seismic Design Category C shall be determined in accordance with Section R301.2.2.2.1

TABLE R502.3.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
 Residential sleeping area, live load = 40 psf. $L/\Delta = 360$ ^b

Source: 2018 NC State Residential Code

JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf			
		2x6	2x8	2x10	2x12
		Maximum floor joist spans			
		(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)
12	Southern pine SS	11-2	14-2	18-0	21-11
	Southern pine #1	10- 9	14- 2	18- 0	21- 11
	Southern pine #2	10-3	13-6	16-2	19-1
	Southern pine #3	8-2	10-3	12-6	14-9
	Spruce-pine- SS	10-6	13-10	17-8	21-6
	Spruce-pine- #1	10-3	13-6	17-3	20-7
	Spruce-pine- #2	10-3	13-6	17-3	20-7
	Spruce-pine- #3	8-8	11-0	13-5	15-7
16	Southern pine SS	10-2	13-4	17-0	20-9
	Southern pine #1	9-9	12-10	16-1	19-1
	Southern pine #2	9-4	11-10	14-0	16-6
	Southern pine #3	7-1	8-11	10-10	12-10
	Spruce-pine- SS	9-6	12-7	16-0	19-6
	Spruce-pine- #1	9-4	12-3	15-5	17-10
	Spruce-pine- #2	9-4	12-3	15-5	17-10
	Spruce-pine- #3	7-6	9-6	11-8	13-6
19.2	Southern pine SS	9-6	12-7	16-0	19-6
	Southern pine #1	9-2	12-1	14-8	17-5
	Southern pine #2	8-6	10-10	12-10	15-1
	Southern pine #3	6-5	8-2	9-10	11-8
	Spruce-pine- SS	9-0	11-10	15-1	18-4
	Spruce-pine- #1	8-9	11-6	14-1	16-3
	Spruce-pine- #2	8-9	11-6	14-1	16-3
	Spruce-pine- #3	6-10	8-8	10-7	12-4
24	Southern pine SS	8-10	11-8	14-11	18-1
	Southern pine #1	8-6	11-3	13-1	15-7
	Southern pine #2	7-7	9-8	11-5	13-6
	Southern pine #3	5-9	7-3	8-10	10-5
	Spruce-pine- SS	8-4	11-0	14-0	17-0
	Spruce-pine- #1	8-1	10-3	12-7	14-7
	Spruce-pine- #2	8-1	10-3	12-7	14-7
	Spruce-pine- #3	6-2	7-9	9-6	11-0

FOR SI" 1" = 25.4 MM, 1 POUND PER SQ FT=0.0479 kPa

- a. End Bearing length shall be increased to 2 inches.
- b. Dead load limits for townhouses in Seismic Design Category C shall be determined in accordance with Section R301.2.2.2.1.

TABLE R502.3.3(1)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING LIGHT
FRAME EXTERIOR BEARING WALL AND ROOF ONLY ^{a, b, c, f, g, h}
(Floor Live Load ≤ 40 psf. Roof Live Load ≤ 20 psf.)

Source: 2018 NC State Residential Code

Member & Spacing	Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs. ^{d, e}		
	Ground Snow Load		
	≤ 20 psf.		
	24 ft.	32 ft.	40 ft.
2 X 8 @ 12"	20" (177)	15" (227)	---
2 X 10 @ 16"	29" (228)	21" (297)	16" (364)
2 X 10 @ 12"	36" (166)	26" (219)	20" (270)
2 X 12 @ 16"	---	32" (287)	25" (356)
2 X 12 @ 12"	---	42" (209)	31" (263)
2 X 12 @ 8"	---	48" (136)	45" (169)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a.** Tabulated values are for clear-span roof supported solely by exterior bearing walls.
- b.** Spans are based on No. 2 Grade lumber of Douglas fir-larch, hem-fir, and spruce-pine-fir for repetitive (three or more) members. No. 1 or better grade lumber shall be used for southern pine or spans shall be multiplied by 0.85 for No. 2 southern pine.
- c.** Ratio of backspan to cantilever span shall be at least 3:1.
- d.** Connections capable of resisting the indicated uplift force shall be provided at the backspan support.
- e.** Uplift force is for a backspan to cantilever span ratio of 3:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to 3 divided by the actual backspan ratio provided (3/backspan ratio).
- f.** See Section R301.2.2.2.5, Item 1, for additional limitations on cantilevered floor joists for townhouses in Seismic Design Category C.
- g.** A full-depth rim joist shall be provided at the unsupported end of the cantilever joists. Solid blocking shall be provided at the supported end. Where the cantilever length is 24 inches or

less, solid blocking at the support for the cantilever shall not be required.

- h. Linear interpolation shall be permitted for building widths and ground snow loads other than shown.

TABLE R502.3.3(2)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING EXTERIOR
BALCONY ^{a, b, e}

Source: 2018 NC State Residential Code

Member & Spacing	Maximum Cantilever Span (Uplift Force at Backspan Support in Lbs. ^{c, d}
	Ground Snow Load
	≤ 40 psf
2 X 8 @ 12"	42" (139)
2 X 8 @ 16"	36" (151)
2 X 10 @ 12"	61' (164)
2 X 10 @ 16"	53" (180)
2 X 10 @ 24"	43" (212)
2 X 12 @ 16"	72" (228)
2 X 12 @ 24"	58" (279)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. Spans are based on No. 2 Grade lumber of douglas fir-larch, hem-fir, and spruce-pine-fir for repetitive (three or more) members. No. 1 or better grade lumber shall be used for southern pine or spans shall be multiplied by 0.85 for No. 2 southern pine.
- b. Ratio of backspan to cantilever span shall be at least 2:1.
- c. Connections capable of resisting the indicated uplift force shall be provided at the backspan support.
- d. Uplift force is for a backspan to cantilever span ratio of 2:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to 2 divided by the actual backspan ratio provided (2/backspan ratio).
- e. A full-depth rim joist shall be provided at the unsupported end of the cantilever joists. Solid blocking shall be provided at the supported end. Where the cantilever length is 24 inches or less, solid blocking at the support for the cantilever shall not be required.
- f. Linear interpolation shall be permitted for building widths and ground snow loads other than shown.

TABLE R802.4(1)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
Uninhabitable attics w/o storage, live load = 10 psf. L./Δ =240

Source: 2018 NC State Residential Code

JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 5 psf			
		2x6	2x8	2x10	2x12
		Maximum floor joist spans			
		(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)
12	Southern pine SS	12-11	20-3	Note a	Note a
	Southern pine #1	12-5	19-6	25-8	Note a
	Southern pine #2	11-10	18-8	24-7	Note a
	Southern pine #3	10-1	14-11	18-9	22-9
	Spruce-pine- SS	12-2	19-1	25-2	Note a
	Spruce-pine- #1	11-10	18-8	24-7	Note a
	Spruce-pine- #2	11-10	18-8	24-7	Note a
	Spruce-pine- #3	10-10	15-10	20-1	24-6
16	Southern pine SS	11-9	18-5	24-3	Note a
	Southern pine #1	11-3	17-8	23-4	Note a
	Southern pine #2	10-9	16-11	21-7	25-7
	Southern pine #3	8-9	12-11	16-3	19-9
	Spruce-pine- SS	11-0	17-4	22-10	Note a
	Spruce-pine- #1	10-9	16-11	22-4	Note a
	Spruce-pine- #2	10-9	16-11	22-4	Note a
	Spruce-pine- #3	9-5	13-9	17-5	21-3
19.2	Southern pine SS	11-0	17-4	22-10	Note a
	Southern pine #1	10-7	16-8	22-0	Note a
	Southern pine #2	10-2	15-7	19-8	23-5
	Southern pine #3	8-0	11-9	14-10	18-0
	Spruce-pine- SS	10-4	16-4	21-6	Note a
	Spruce-pine- #1	10-2	15-11	21-0	25-8
	Spruce-pine- #2	10-2	15-11	21-0	25-8
	Spruce-pine- #3	8-7	12-6	15-10	19-5
24	Southern pine SS	10-3	16-1	21-2	Note a
	Southern pine #1	9-10	15-6	20-5	24-0
	Southern pine #2	9-3	13-11	17-7	20-11
	Southern pine #3	7-2	10-6	13-3	16-1
	Spruce-pine- SS	9-8	15-2	19-11	25-5
	Spruce-pine- #1	9-5	14-9	18-9	22-11
	Spruce-pine- #2	9-5	14-9	18-9	22-11
	Spruce-pine- #3	7-8	11-2	14-2	17-4

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa.

a. Span exceeds 26 feet in length.

TABLE R802.4(2)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
Uninhabitable attics w/LIMITED storage, live load = 20 psf. L./Δ =240
Source: 2018 NC State Residential Code

JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 5 psf			
		2x6	2x8	2x10	2x12
		Maximum floor joist spans			
		(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)
12	Southern pine SS	10-3	16-1	21-2	Note a
	Southern pine #1	9-10	15-6	20-5	24-0
	Southern pine #2	9-3	13-11	17-7	20-11
	Southern pine #3	7-2	10-6	13-3	16-1
	Spruce-pine- SS	9-8	15-2	19-11	25-5
	Spruce-pine- #1	9-5	14-9	18-9	22-11
	Spruce-pine- #2	9-5	14-9	18-9	22-11
	Spruce-pine- #3	7-8	11-2	14-2	17-4
16	Southern pine SS	9-4	14-7	19-3	24-7
	Southern pine #1	8-11	14-0	17-9	20-9
	Southern pine #2	8-0	12-0	15-3	18-1
	Southern pine #3	6-2	9-2	11-6	14-0
	Spruce-pine- SS	8-9	13-9	18-1	23-1
	Spruce-pine- #1	8-7	12-10	16-3	19-10
	Spruce-pine- #2	8-7	12-10	16-3	19-10
	Spruce-pine- #3	6-8	9-8	12-4	15-0
19.2	Southern pine SS	8-9	13-9	18-2	23-1
	Southern pine #1	8-5	12-9	16-2	18-11
	Southern pine #2	7-4	11-0	13-11	16-6
	Southern pine #3	5-8	8-4	10-6	12-9
	Spruce-pine- SS	8-3	12-11	17-1	21-8
	Spruce-pine- #1	8-0	11-9	14-10	18-2
	Spruce-pine- #2	8-0	11-9	14-10	18-2
	Spruce-pine- #3	6-1	8-10	11-3	13-8
24	Southern pine SS	8-1	12-9	16-10	21-6
	Southern pine #1	7-8	11-5	14-6	16-11
	Southern pine #2	6-7	9-10	12-6	14-9
	Southern pine #3	5-1	7-5	9-5	11-5
	Spruce-pine- SS	7-8	12-0	15-10	19-5
	Spruce-pine- #1	7-2	10-6	13-3	16-3
	Spruce-pine- #2	7-2	10-6	13-3	16-3
	Spruce-pine- #3	5-5	7-11	10-0	12-3

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa.

a. Span exceeds 26 feet in length.

TABLE R802.5.1(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
CEILING NOT ATTACHED TO RAFTERS
(Roof live load = 20 psf. L./Δ = 180)

Source: 2018 NC State Residential Code

JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf			
		2x6	2x8	2x10	2x12
		Maximum floor joist spans ^a			
		(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)
12	Southern pine SS	11-3	17-8	23-4	Note b
	Southern pine #1	10-10	17-0	22-5	Note b
	Southern pine #2	10-4	15-7	19-8	23-5
	Southern pine #3	8-0	11-9	14-10	18-0
	Spruce-pine- SS	10-7	16-8	21-11	Note b
	Spruce-pine- #1	10-4	16-3	21-0	25-8
	Spruce-pine- #2	10-4	16-3	21-0	25-8
	Spruce-pine- #3	8-7	12-6	15-10	19-5
16	Southern pine SS	10-3	16-1	21-2	Note b
	Southern pine #1	9-10	15-6	19-10	23-2
	Southern pine #2	9-0	13-6	17-1	20-3
	Southern pine #3	6-11	10-2	12-10	15-7
	Spruce-pine- SS	9-8	15-2	19-11	25-5
	Spruce-pine- #1	9-5	14-4	18-2	22-3
	Spruce-pine- #2	9-5	14-4	18-2	22-3
	Spruce-pine- #3	7-5	10-10	13-9	16-9
19.2	Southern pine SS	9-8	15-2	19-11	25-5
	Southern pine #1	9-3	14-3	18-1	21-2
	Southern pine #2	8-2	12-3	15-7	18-6
	Southern pine #3	6-4	9-4	11-9	14-3
	Spruce-pine- SS	9-1	14-3	18-9	23-11
	Spruce-pine- #1	8-10	13-1	16-7	20-3
	Spruce-pine- #2	8-10	13-1	16-7	20-3
	Spruce-pine- #3	6-9	9-11	12-7	15-4
24	Southern pine SS	8-11	14-1	18-6	23-8
	Southern pine #1	8-7	12-9	16-2	18-11
	Southern pine #2	7-4	11-0	13-11	16-6
	Southern pine #3	5-8	8-4	10-6	12-9
	Spruce-pine- SS	8-5	13-3	17-5	21-8
	Spruce-pine- #1	8-0	11-9	14-10	18-2
	Spruce-pine- #2	8-0	11-9	14-10	18-2
	Spruce-pine- #3	6-1	8-10	11-3	13-8

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa.

TABLE R802.5.1(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
CEILING NOT ATTACHED TO RAFTERS
(Roof live load = 20 psf. $L/\Delta = 180$)

Source: 2018 NC State Residential Code

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

<u>HC/R</u>	<u>Rafter Span Adjustment Factor</u>
<u>1/3</u>	<u>0.67</u>
<u>1/4</u>	<u>0.76</u>
<u>1/5</u>	<u>0.83</u>
<u>1/6</u>	<u>0.90</u>
<u>1/7.5 or less</u>	<u>1.00</u>

Where:

HC = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

HR = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

TABLE R802.5.1(2)
RAFTER SPANS FOR COMMON LUMBER SPECIES
CEILING NOT ATTACHED TO RAFTERS
(Roof live load = 20 psf. L./Δ = 240)

Source: 2018 NC State Residential Code

JOIST SPACING (inches)	SPECIES AND GRADE	DEAD LOAD = 10 psf			
		2x6	2x8	2x10	2x12
		Maximum floor joist spans ^a			
		(ft.-in.)	(ft.-in.)	(ft.-in.)	(ft.-in.)
12	Southern pine SS	10-3	16-1	21-2	Note b
	Southern pine #1	9-10	15-6	20-5	Note b
	Southern pine #2	9-5	14-9	19-6	23-5
	Southern pine #3	8-0	11-9	14-10	18-0
	Spruce-pine- SS	9-8	15-2	19-11	25-5
	Spruce-pine- #1	9-5	14-9	19-6	24-10
	Spruce-pine- #2	9-5	14-9	19-6	24-10
16	Spruce-pine- #3	8-7	12-6	15-10	19-5
	Southern pine SS	9-4	14-7	19-3	24-7
	Southern pine #1	8-11	14-1	18-6	23-2
	Southern pine #2	8-7	13-5	17-1	20-3
	Southern pine #3	6-11	10-2	12-10	15-7
	Spruce-pine- SS	8-9	13-9	18-1	23-1
	Spruce-pine- #1	8-7	13-5	17-9	22-3
19.2	Spruce-pine- #2	8-7	13-5	17-9	22-3
	Spruce-pine- #3	7-5	10-10	13-9	16-9
	Southern pine SS	8-9	13-9	18-2	23-1
	Southern pine #1	8-5	13-3	17-5	21-2
	Southern pine #2	8-1	12-3	15-7	18-6
	Southern pine #3	6-4	9-4	11-9	14-3
	Spruce-pine- SS	8-3	12-11	17-1	21-9
24	Spruce-pine- #1	8-1	12-8	16-7	20-3
	Spruce-pine- #2	8-1	12-8	16-7	20-3
	Spruce-pine- #3	6-9	9-11	12-7	15-4
	Southern pine SS	8-1	12-9	16-10	21-6
	Southern pine #1	7-10	12-3	16-2	18-11
	Southern pine #2	7-4	11-10	13-11	16-6
	Southern pine #3	5-8	8-4	10-6	12-9
24	Spruce-pine- SS	7-8	12-0	15-10	20-2
	Spruce-pine- #1	7-6	11-9	14-10	18-2
	Spruce-pine- #2	7-6	11-9	14-10	18-2
	Spruce-pine- #3	6-1	8-10	11-3	13-8

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa.

TABLE R802.5.1(2)
RAFTER SPANS FOR COMMON LUMBER SPECIES
CEILING NOT ATTACHED TO RAFTERS
(Roof live load = 20 psf. $L/\Delta = 240$)

Source: 2018 NC State Residential Code

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. When ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the factors given below:

<u>HC/R</u>	<u>Rafter Span Adjustment Factor</u>
<u>1/3</u>	<u>0.67</u>
<u>1/4</u>	<u>0.76</u>
<u>1/5</u>	<u>0.83</u>
<u>1/6</u>	<u>0.90</u>
<u>1/7.5 or less</u>	<u>1.00</u>

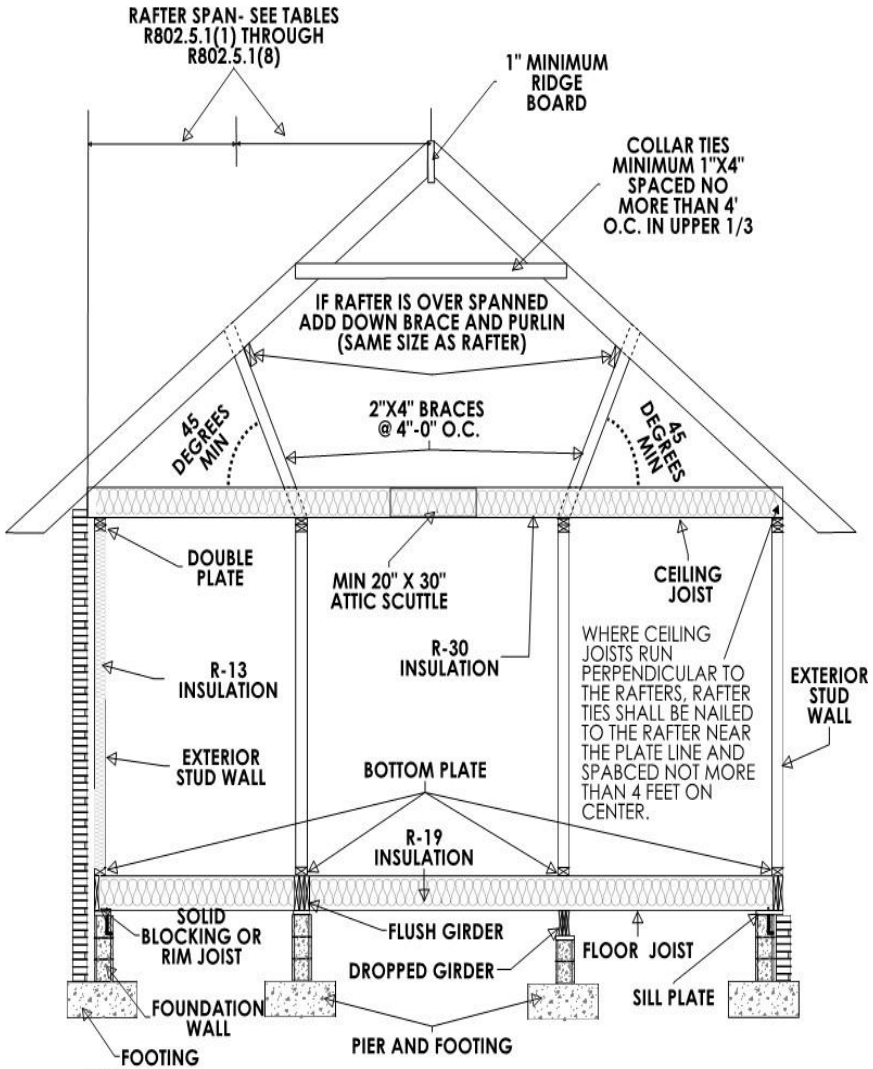
Where:

HC = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls.

HR = Height of roof ridge measured vertically above the top of the rafter support walls.

- b. Span exceeds 26 feet in length.

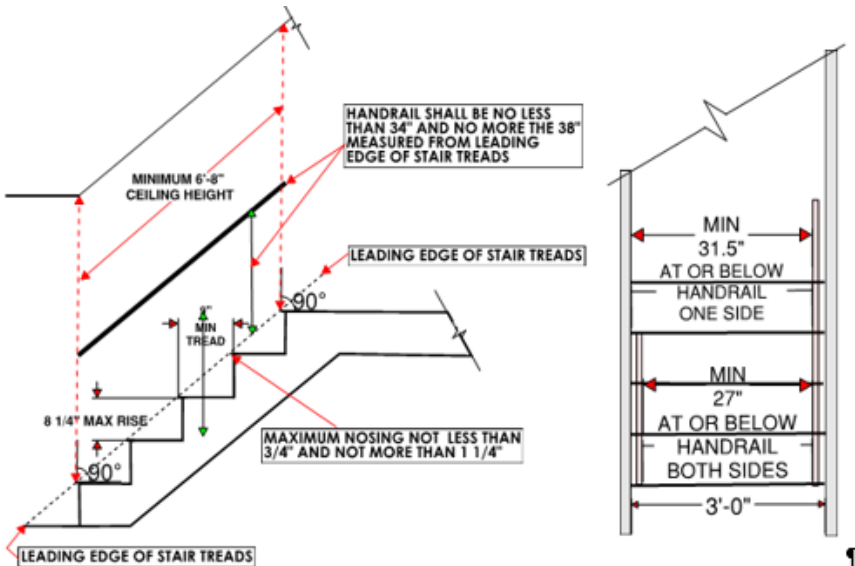
ROOF DOWN BRACING



NOTES:

PURLINS MAY BE INSTALLED TO REDUCE THE SPAN OF RAFTERS. PURLINS SHALL BE SIZED NO LESS THAN THE REQUIRED SIZE OF RAFTERS THEY SUPPORT. PURLINS SHALL BE SUPPORTED BY 2X4 STRUTS INSTALLED TO BEARING WALLS AT A SLOPED NOT LESS THAN 45 DEGREES FROM HORIZONTAL. THE STRUTS SHALL BE SPACED NOT MORE THAN 4'-0" O.C., AND THE UNBRACED LENGTH OF STRUTS SHALL NOT EXCEED 5'-0". COLLAR TIES SHALL BE NAILED IN THE UPPER THIRD OF THE ROOF TO EVERY THIRD PAIR OF RAFTERS NOT TO EXCEED 4'-0" O.C.

STAIRWAYS



R311.7.1 Width. Stairways **shall not be less than 36 inches** (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than **4.5 inches** (114 mm) on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than **31-1/2 inches** (787mm) where a handrail is installed on one side and **27 inches** (698 mm) where handrails are provided on both sides. **Exception:** Spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.2 Headroom. The minimum =the sloped line adjoining the tread nosing or from the floor surface of the landing or platform on that portion of the stairway.

Exception: Where the nosing of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall be allowed to project horizontally into the required headroom a maximum of **4-3/4 inches** (121 mm).

R311.7.5.1 Riser height. The maximum riser height shall be **8-1/4 inches** (210 mm). Measured vertically between leading edges of the adjacent treads. Greatest riser height shall not exceed the smallest by more than **3/8 inch** (9.5mm). The top and bottom riser of interior stairs shall not exceed the smallest riser within that stair run by more than **3/4 inch** (19 mm). The height of the top and bottom riser of the interior stairs shall be measured from the permanent finished surface (carpet excluded). Where the bottom riser of an exterior stair adjoins an exterior walk, porch, driveway, patio, garage floor, or finish grade, the height of the riser may be less than the height of the adjacent risers.

R311.7.5.2 Tread depth. Minimum tread depth shall be **9 inches** (229 mm). Measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth shall not exceed the smallest by more than **3/8 inch** (9.5 mm). **FOR WINDER TREADS REFER TO 2018 NCRC**

R311.7.5.3 Nosing. The radius of curvature at the nosing shall be no greater than 9/16 inch (14 mm). A nosing not less than 3/4 inch but not more than **1-1/4 inches** shall be provided on stairways with solid risers. The greatest nosing projection shall not exceed the smallest nosing projection by more than **3/8 inch** (9.5 mm) between two stories, including the nosing at the level of floors and landings. Beveling of nosing shall not exceed **1/2 inch** (12.7 mm). Risers shall be vertical or sloped under the tread above from the underside of the nosing above at an angle not more than **30 degrees** (0.51 rad) from the vertical. Open risers are permitted, provided that the opening between treads does not permit the passage of a **4-inch diameter** (102 mm) sphere.

Exceptions:

1. A nosing is not required where the tread depth is a minimum of **11 inches** (279 mm).
2. The opening between adjacent treads is not limited on stairs with a total rise of 30 inches (762 mm) or less.

FIREBLOCKING, DRAFTSTOPPING, OR FIRESTOPPING

People in the building industry believe these terms to be interchangeable, and / or to be one and the same. However, their use and purpose is very different.

1. **Fireblock** is a material whose main purpose is to be used in concealed locations of combustible construction to prevent fire from quickly spreading through these spaces. Such a material will, as an inherent characteristic, also slow the migration of smoke throughout the building. Fireblock is typically applied in a horizontal position to prevent the spread of fire (and thus air) in a vertical manner.
2. **Draftstop** is a material whose main purpose is to be used in concealed locations of combustible construction to prevent the movement of slow air (oxygen) within open or concealed areas. Similar to firestopping, such a material will, as an inherent characteristic, also slow the migration of smoke throughout the building. Draftstopping is typically applied in a vertical position to prevent the spread of air in a horizontal manner (think compartmentation), within concealed spaces such as attics, crawlspaces, floor-ceiling and/or roof-ceiling assemblies.

- 3. Firestop** material is tested and approved for use in a specific construction detail that reflects the installed assembly, meant to protect rated penetrations by pipe, wire, etc., to the same degree as the fire-rated wall, ceiling or floor that is being penetrated.

What are acceptable fire blocking materials?

Types of material used as fireblock. As per 2018 North Carolina Residential Code (NCRC), Section R302.11 [R602.8] Fireblocking shall consist of:

- Two-inch (51mm) nominal lumber.
- Two thicknesses of 1-inch (25.4mm) nominal lumber with broken lap joints.
- One thickness of 23/32-inch (18.3 mm) wood structural panels with joints backed by 23/32-inch (18.3 mm) wood structural panels.
- One thickness of 3/4-inch (19.1 mm) particleboard with joints backed by 3/4-inch (19.1 mm) particleboard.
- One-half inch (12.7 mm) gypsum board.
- One-quarter inch (6.4 mm) cement-based millboard.
- Batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place.
- Cellulose insulation installed as tested in accordance with ASTM E119 or UL 263, for Specific application.

R1003.19 Chimney Fire Blocking: Wood fire blocking materials or other Wood fire blocking materials or other combustible items cannot be used up against chimneys regardless of the thickness.

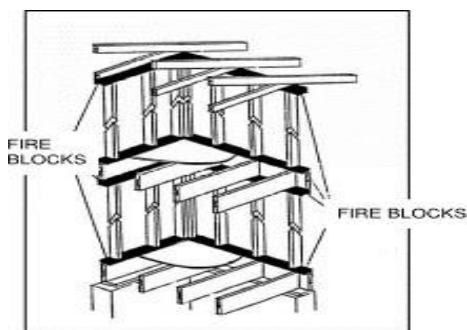


Figure 2- Fireblock

Examples of where Fireblocking is used.

- Separate open vertical spaces from open horizontal spaces, (Figure 2)
- The top and bottom of stairs, between stringers,
- Within architectural trim, such as furred out wall finishes, wainscoting, soffits, siding, DOI File # WP-060-11 Fireblocking Page 3 of 7 etc., (Figure 3).
- Sleeper spaces, such as raised floor,

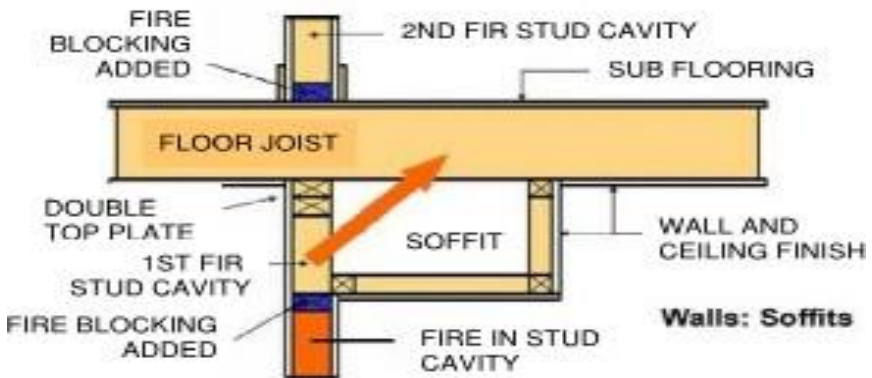


Figure 3— Fireblock at Soffits

- Fill in spaces at floor and/or ceiling in fire-partitions constructed of combustible materials,
- Unrated membrane penetrations, such as when a hole for a pipe or duct is cut out too large to be filled properly with firestop material, the excess area can be filled with non-combustible fireblock, and then the annular area around the pipe/duct is filled with firestop material. (Figure 4)

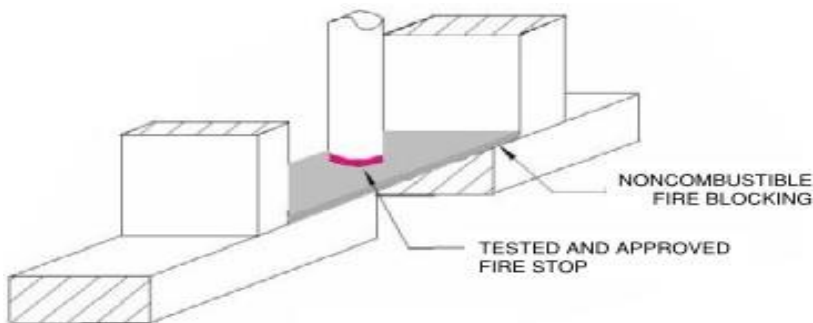
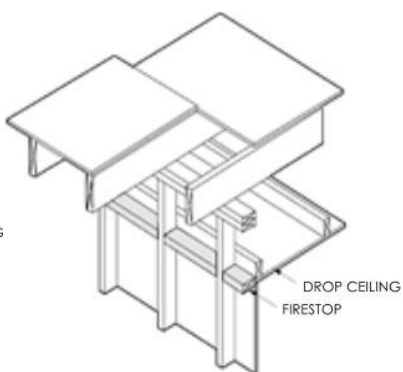
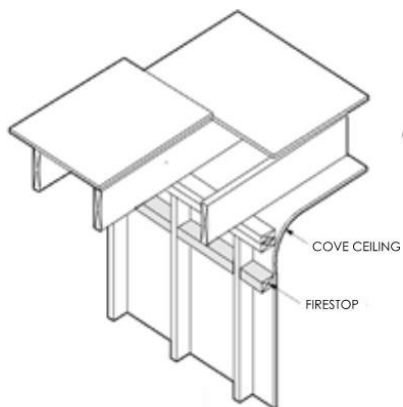


Figure 4 - Membrane Firestop with non-combustible fireblocking

T and F Ratings: What are T and F ratings?

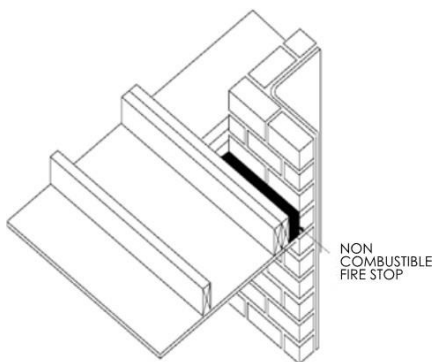
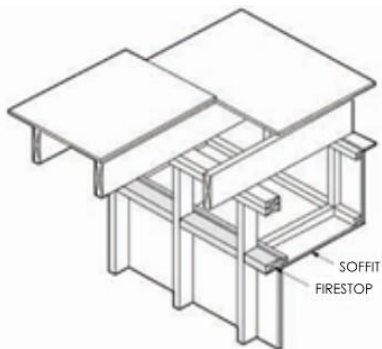
T and F ratings are not applicable to Fireblock products; they apply only to Firestop, which are tested to resist the passage of fire traditionally around penetrating items such as pipes or wires. Their definitions can be found in the NC Building Codes and are reprinted below.

- A. **F RATING:** The time period that the through-penetration firestop system limits the spread of fire through the penetration when tested in accordance with ASTM E 814 or UL-1479.
- B. **T RATING:** The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the non-fire side when tested in accordance with ASTM E 814 or UL-1479.
- C. **THROUGH-PENETRATION FIRESTOP SYSTEM:** An assemblage of specific materials or products that are designed, tested and fire-resistance rated to resist for a prescribed period of time the spread of fire through-penetrations. The F and T rating criteria for penetration firestop systems shall be in accordance with ASTM E814 or UL 1479. See definitions of “F rating” and “T rating.”

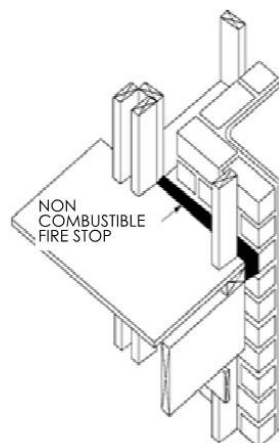
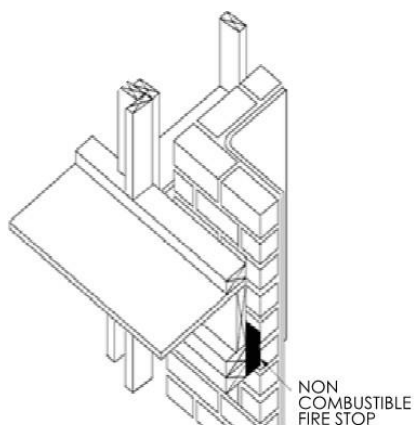


FIRESTOPPING-COVE CEILING

FIRESTOPPING-DROPPED CEILING



FIRESTOPPING-FURRED SOFFIT



FIRESTOPPING-FURRED SOFFIT

GLAZING

R308.4 Hazardous locations: The following shall be considered specific hazardous locations for the purposes of glazing:

1. **Doors:** Glazing in fixed and operable panels of swinging, sliding and bi-fold doors.

Exceptions:

- I. Glazed openings of a size through which a 3-inch diameter (76 mm) sphere is unable to pass.
 - II. Decorative glazing.
2. **Adjacent to Doors:** Glazing in an individual fixed or operable panel in the same plane as the door where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the floor or walking surface and where the glazing is within 24 inches (610 mm) of either side of the door in a closed position.

Exceptions:

- I. Decorative glazing.
- II. When there is an intervening wall or other permanent barrier between the door and the glazing.
- III. Glazing adjacent to a door where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. This must comply with Section R308.4.3.
- IV. Glazing that is adjacent to the fixed panel of patio doors.

3. **Windows:** Glazing in an individual fixed or operable panel that meets all of the following conditions are considered hazardous locations:

- The exposed area of an individual pane is **larger than 9 square feet** (0.836 m²); and
- The **bottom edge** of the glazing is **less than 18 inches** (457 mm) above the floor; and
- The **top edge** of the glazing is **more than 36 inches** (914 mm), above the floor; and
- One or more walking surfaces are within 36 inches (914 mm), measured horizontally and in a straight line, of the glazing.

Exceptions:

- I. Decorative glazing.
- II. Where a horizontal rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be a minimum of 1-1/2 inches (38 mm) in cross sectional height.
- III. Outboard panes in insulating glass units and other multiple glazed panels where the bottom edge of the glass is 25 feet (7620 mm) or more above grade, a roof, walking surfaces or other horizontal [within 45 degrees (0.79 rad) of horizontal] surface adjacent to the glass exterior.

4. **Glazing in railings and guards** regardless of area or height above a walking surface. Included are structural baluster panels and nonstructural infill panels.

5. **Wet Surfaces:** Glazing in walls, enclosures or fences containing or facing hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers, and indoor or outdoor swimming pools where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface. This applies to single glazing and each pane in multiple glazing.

Exception: Glazing that is more than 60 inches (1524 mm), measured horizontally and in a straight line, from the water's edge of a bathtub, hot tub, spa, whirlpool or swimming pool or from the edge of a shower, sauna or steam room.

6. **Glazing adjacent to stairs and ramps:** Glazing where the bottom edge of the glazing is less than 36 inches (914 mm) above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps.

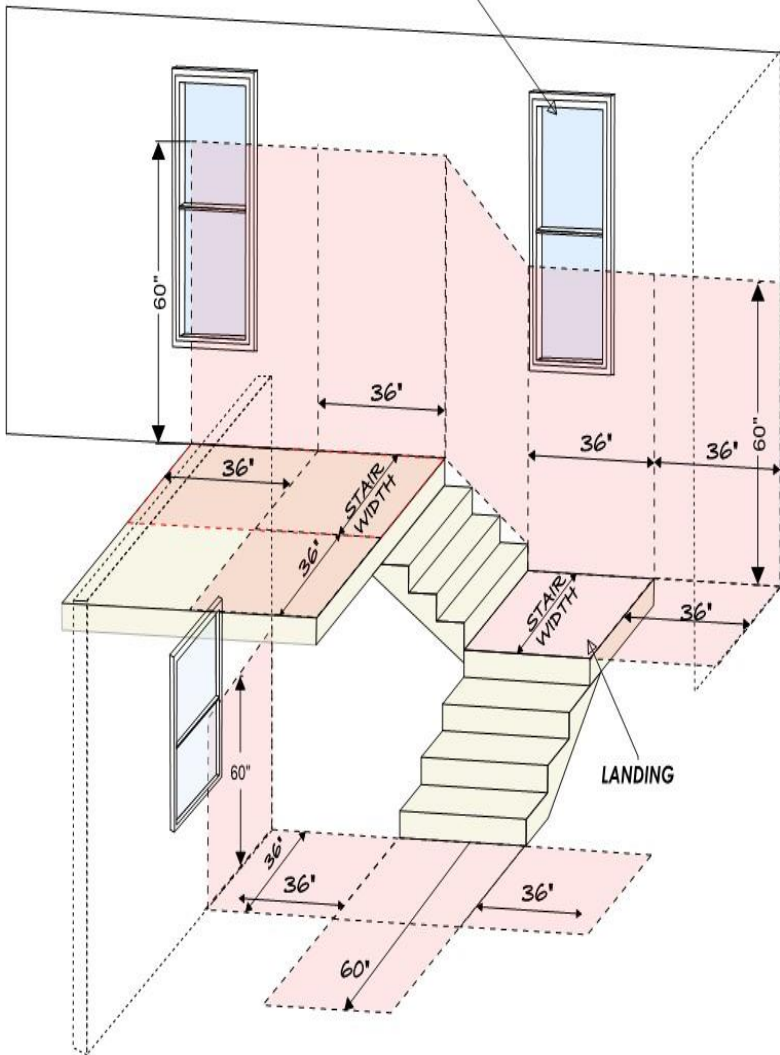
Exceptions:

- I. Where a rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be a minimum of 1-1/2 inches (38 mm) in cross sectional height.
- II. Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.
- III. Where a change in elevation is 8 1/4 inches (210 mm) or less at an exterior door.

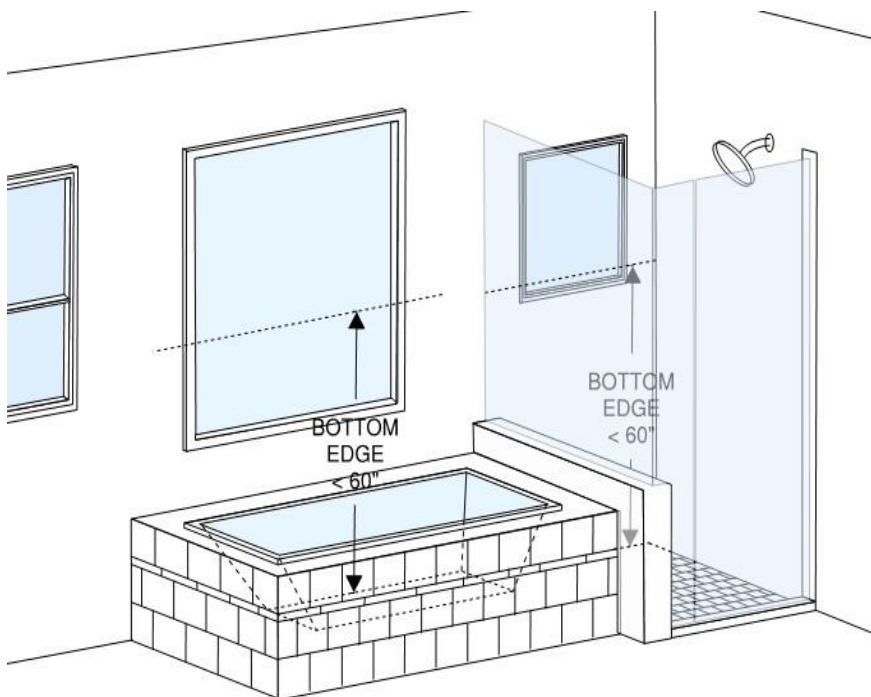
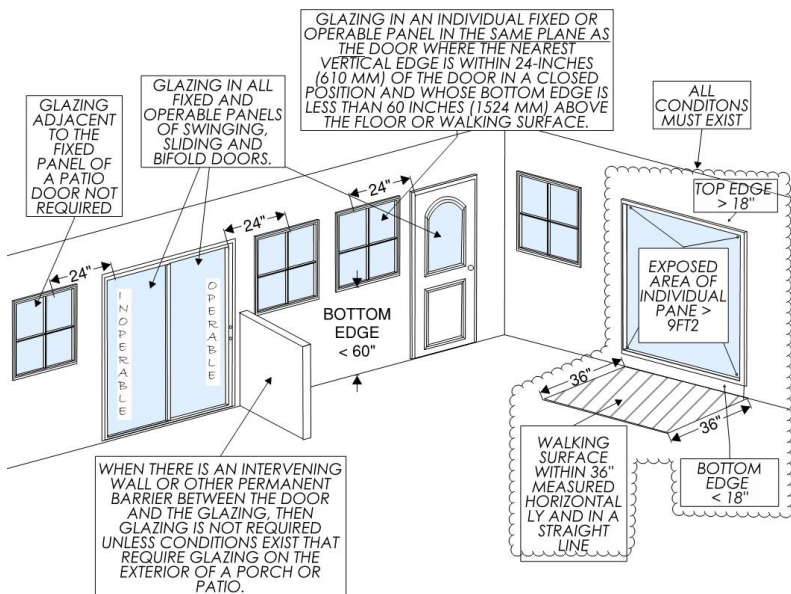
7. **Glazing adjacent to the bottom stair landing:** Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 36 inches (914 mm) above the landing and within a 60-inch (1524 mm) horizontal arc less than 180 degrees from the bottom tread nosing.

Exception: The glazing is protected by a guard complying with Section R312 and the plane of the glass is more than 18 inches (457 mm) from the guard.

IF THE WINDOW IS DOUBLE HUNG AND THE BOTTOM OF THE WINDOW IS 60" OR LESS TO THE LANDING THEN BOTH SASHES WILL NEED TO BE TEMPERED BECAUSE THE TOP SASH COULD BE LOWERED INTO THE REQUIREMENT AREA FOR GLAZING. IF THE WINDOW IS SINGLE HUNG AND THE TOP SASH IS NOT WITHIN THE 60" THEN ONLY THE BOTTOM SASH WOULD HAVE TO MEET GLAZING REQUIREMENTS.



TEMPERED GLAZING LOCATIONS



TEMPERED GLAZING LOCATIONS

Skylights and sloped glazing R308.6

PERMITTED MATERIALS

1. GLASS AREA 16 SQ FT OR LESS LAMINATED GLASS WITH A MINIMUM 0.015-INCH (0.38MM) POLYVINYL BUTYRAL INTERLAYER, HIGHEST POINT OF GLASS NOT MORE THAN 12 FT ABOVE A WALKING SURFACE OR OTHER ACCESSIBLE AREA. THE MINIMUM INTERLAYER THICKNESS SHALL BE 0.030 INCH (0.76 MM).
FOR HIGHER OR LARGER SIZES, THE MINIMUM INTERLAYER THICKNESS SHALL BE 0.030 INCH (0.76MM)
2. FULLY TEMPERED GLASS
3. HEAT-STRENGTHENED GLASS
4. WIRED GLASS
5. APPROVED RIGID PLASTICS.

R308.6.3 Screens, general. For fully tempered or heat-strengthened glass, a retaining screen meeting the requirements of Section R308.6.7 shall be installed below the glass, except for fully tempered glass that meets either condition listed in Section R308.6.5.

R308.6.4 Screens with multiple glazing. Where the inboard pane is fully tempered, heat-strengthened or wired glass, a retaining screen meeting the requirements of Section R308.6.7 shall be installed below the glass, except for either condition listed in Section R308.6.5. Other panes in the multiple glazing may be of any type listed in Section R308.6.2.

R308.6.5 Screens not required. Screens shall not be required where fully tempered glass is used as single glazing or the inboard pane in multiple glazing and either of the following conditions are met:

- I. Glass area 16 square feet (1.49 m²) or less. Highest point of glass not more than 12 feet (3658 mm) above a walking surface or other accessible area, nominal glass thickness not more than 3/16 inch (4.8 mm), and (for multiple glazing only) the other pane or panes fully tempered, laminated or wired glass.
- II. Glass area greater than 16 square feet (1.49m²). Glass sloped 30 degrees (0.52 rad) or less from vertical, and highest point of glass not more than 10 feet (3048 mm) above a walking surface or other accessible area.

INSULATION

1. When is an insulation inspection required?

NCACP Section 107.1.6 Insulation inspection shall be made after an approved building framing and rough-in inspection and after the permanent roof covering is installed, with all insulation and vapor retarders in place, but before any wall or ceiling covering is applied.

2. What are the minimum R-values required for walls, floors and ceilings?

Table N1102.1 Insulation shall be a minimum of R-15 in walls, R-38 in ceilings and R-19 in floors. This is for zone 3 which is Mecklenburg County.

3. What is the maximum slope a ceiling can be before blown insulation cannot be used?

Typically, manufacturer's information discourages using blown insulation for sloped ceilings. Insulation batts must be used. Blown insulation can only be used for flat ceilings unless specified for sloped ceilings by the manufacture.

4. Are insulation markers necessary when using blown insulation in the attic?

Section N1101.10.2 Yes, where blown -in or sprayed insulation is applied in the roof-ceiling assembly, the installer shall provide a certification of the initial installed thickness, settled thickness, coverage area, and number of bags of insulating material installed. Markers shall be provided for every 300 square feet of attic area, attached to the trusses, rafters, or joists and indicate in 1-inch high numbers the installed thickness of the insulation. The depth markers shall be installed to the roof-ceiling assembly at time of wall insulation

and be viewable at the insulation inspection along with the baffles.

FINAL INSPECTION

1. When is a final inspection required?

NCACP Section 107.1.8 Final inspections shall be made for each trade after completion of the work authorized under the technical codes.

2. Is a separation required between the garage and the living area?

Section R302.6 Dwelling/garage fire separation. The garage shall be separated as required by table R302.6 ([next page](#)). Openings in garage walls shall comply with Section R302.5. This provision does not apply to garage walls that are perpendicular to the adjacent dwelling unit wall.

R302.7 Under-stair protection. Enclosed accessible space under stairs shall have walls, under stair surface and any soffits protected on the enclosed side with 1/2-inch (12.7 mm) gypsum board.

(continued on next page)

TABLE R302.6
DWELLING/GARAGE SEPARATION

Source: 2018 NC State Residential code

SEPARATION	MATERIAL
From the residence and attics	Not less than 1/2-inch gypsum board or equivalent applied to the garage side.
From all habitable rooms above the garage.	Not less than 5/8-inch Type X gypsum board or equivalent.
Structure(s) supporting floor/ceiling assemblies used for separation required by this section.	Not less than 1/2-inch Type X gypsum board or equivalent.
Garages located less than 3 feet from a dwelling unit on the same lot.	Not less than 1/2-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm

3. How much can a handrail project into the stairway?

Section R311.7 Stairways shall not be less than 36 inches in clear width at all points above the permitted handrail height and below the required headroom height. Handrails shall not project more than 4.5 inches on either side of the stairway. The minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31.5 inches where a handrail is installed on one side and 27 inches where handrails are provided on both sides.

SEE PAGE 69 OF THIS BOOKLET FOR ILLUSTRATION.

4. How many risers are needed before a handrail is required?

Section R311.7.8 A handrail shall be provided on at least one side of a stairway if it has (4) four or more risers.

Section R312.1 If the stairway is more than 30 inches above grade, then **handrail and guardrails** are required. If the stairway is open on

both sides, then handrail and guardrail would be required on both sides.

Section R311.7.8.3 Exterior handrails (Decks, garages, and areas exposed to weather) shall not be more than 3-1/2 inches in cross section dimension.

5. Are returns at the end of handrails required on all handrails?

Section R311.7.8.2 Continuity. Handrails for stairways shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1-1/2 inch (38 mm) between the wall and the handrails.

Exceptions:

- I. Handrails shall be permitted to be interrupted by a newel post at the turn.
- II. The use of a volute, turnout starting easing, or starting newel shall be allowed over the lowest tread.
- III. Two or more separate rails shall be considered continuous if the termination of the rails occurs within 6 inches (152 mm) of each other. If transitioning between a wall-mounted handrail and a guardrail/handrail, the wall-mounted rail must return into the wall.

6. Are foundation drains allowed to terminate outside the foundation wall underground?

Section R405.2.3 The drainage system shall discharge into an approved sewer system or to daylight.

7. Is regular gypsum board acceptable material at shower and bath area?

Section R702.3.7 & R307.2 Gypsum board utilized as the base or backer board for adhesive application of ceramic tile or other nonabsorbent finish material shall conform to ASTM C630 or C1178. Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a

nonabsorbent surface. Such wall surfaces shall extend to a height of not less than 6 feet above the floor.

8. What is an acceptable location for the insulation certificate?

Section N1101.14 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel, in the attic next to the attic insulation card, or inside a kitchen cabinet or other approved location. The certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The builder, permit holder, or registered design professional shall be responsible for completing the certificate. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and floor) and duct outside conditioned spaces; *U*-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall indicate whether the building air leakage was visually inspected as required in Section N1102.4.2.1 or provide results of the air leakage testing required in Section N1102.4.2.2 The certificate shall provide results of duct leakage test required in Section N1103.3.3. Appendix E-1 in the NCRC contains a sample certificate.

9. What are the more common items that inspectors look at during the Building Final Inspection?

- Blown insulation is completed with an insulation certificate card posted in the attic.
- Pull downstairs are installed per manufacturer's requirements.
- Glass shower enclosures are complete and the required tempered stamp present.
- Wall rails and banisters are properly installed.
- Garage area is properly fire stopped.
- All exterior penetrations are sealed.
- All exterior wood has at least a prime coat of paint.

- House numbers are installed.
- Final grading has positive drainage away from the residence.

EXTERIOR WOOD DECKS

1. A deck is an exposed exterior wood floor structure which may be attached to the structure or freestanding. Roofed porches (open or screened-in) may be constructed using these provisions.
2. Support posts shall be supported by a footing.

FOOTING CHART

Source: 2018 NC State Residential Code

TABLE AM102.1 FOOTING TABLE ^{a, b, c}				
SIZE (inches)		TRIBUTARY AREA (square feet)	THICKNESS (inches)	
Precast Footings A x A	Cast-In- Place Footings B x C		Precast	Cast-In- Place
8 X 16	8 X 16	36	4	6
12 X 12	12 X 12	40	4	6
16 X 16	16 X 16	70	8	8
---	16 x 24	100	---	8
---	24 x 24	150	---	8

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929m²

- a. Footing values are based on single floor and roof loads.
- b. Support post must rest in center 1/3 of footer.
- c. Top of footer shall be level for full bearing support of post.

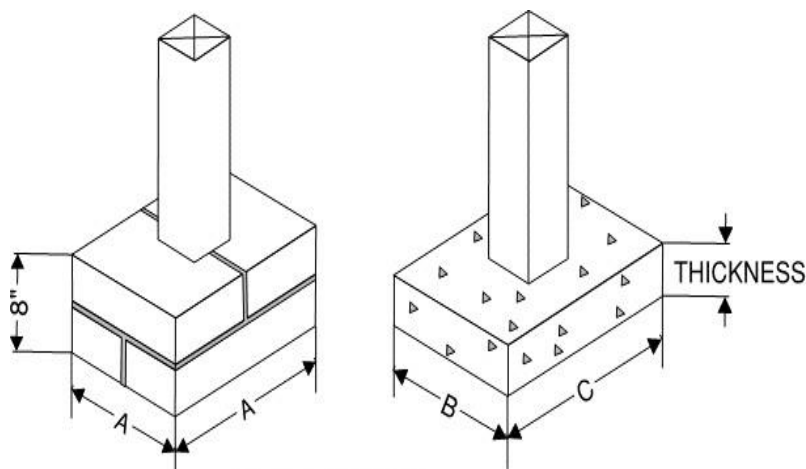
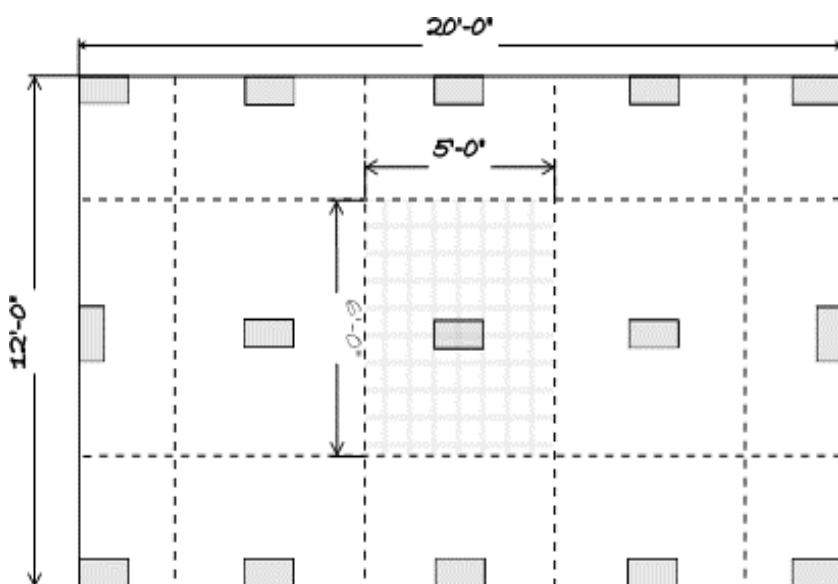


FIGURE AM102

Note: Tributary area of shaded section on free standing deck shown is 5' x 6' = 30 sq. ft. Code will require minimum footer of 8" x 16" per Table AM102.1. (SEE BELOW)



Source: 2018 NC State Residential Code

FLASHING

AM103.1 When attached to a structure, the structure to which attached shall have a treated wood band for the length of the deck, **OR** corrosion-resistant flashing shall be used to prevent moisture from coming in contact with the untreated framing of the structure. **Aluminum flashing shall not be used** in conjunction with deck construction. The deck band and the structure band shall be constructed in contact with each other except on brick veneer structures and where plywood sheathing is required and properly flashed. Siding shall not be installed between the structure and the deck band. If attached to a brick structure, neither the flashing nor a treated house band for brick structure is required. In addition, the treated deck band shall be constructed in contact with the brick veneer. **Flashing shall be installed per Figure AM103.1 SEE NEXT PAGE.**

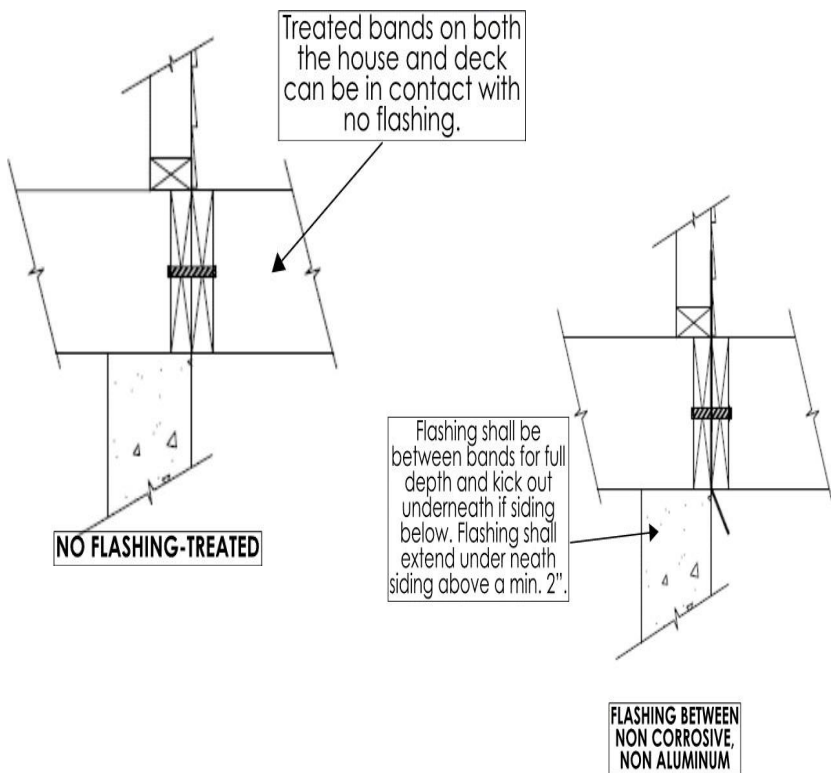


FIGURE AM103.1
FLASHING FOR DECK ATTACHED TO STRUCTURE

Source: 2018 NC State Residential Code

DECK ATTACHMENT

AM104.1 When the deck is supported at the structure by attaching the deck to the structure, the following attachment schedules shall apply for attaching the deck band to the structure.

Source: 2018 NC State Residential Code

TABLE AM104.1(1)			
DECK ATTACHMENT FOR ALL STRUCTURES EXCEPT BRICK VENEER			
Method	Fasteners	8' Max. Joist Span ^a	16' Max. Joist Span ^a
1	5/8" Hot Dipped Galv. Bolts w/ nut and washer ^b and 12d Common Hot Dipped Galv. Nails ^c	1 @ 3'-6" O.C. and 2 @ 8" O.C.	1 @ 1'-8" O.C. and 3 @ 6" O.C.
OR			
2	Self-Drilling Screw Fastener ^d	12" O.C. staggered	6" O.C. staggered
TABLE AM104.1(2)			
DECK ATTACHMENT FOR BRICK VENEER STRUCTURES			
Fasteners		8' Max. Joist Span ^a	16' Max. Joist Span ^a
5/8" Hot Dipped Galv. Bolts w/ nut and washer ^b		1 @ 2'-4" O.C.	1 @ 1'-4" O.C.

- a.** Attachment interpolation between 8 foot & 16 foot joist span are allowed.
- b.** Minimum edge distance for bolts is 2-1/2 inches.
- c.** Nails must penetrate supporting structure band a minimum of 1-1/2 inches.
- d.** Self-drilling drilling fastener shall be an approved screw having a minimum shank diameter of 0.195" and a length long enough to penetrate through the supporting structure band. The structure band shall have a minimum depth of 1-1/8". Screw shall have an evaluated allowable shear load for Southern Pine to Southern Pine lumber of 250 pounds and shall have a corrosion resistant finish equivalent to hot dipped galvanized. Minimum edge distance for screws is 1-7/16". A minimum of 1/2" thick wood structural panel if permitted to be located between the deck and the structural band.

MASONRY LEDGE SUPPORT

AM104.1.1 If the deck band is supported by a minimum of 1/2-inch masonry ledge along the foundation wall, 5/8-inch hot dipped galvanized bolts with washers spaced at 48 inches o. c. may be used for support.

OTHER MEANS OF SUPPORT

AM104.1.2 Joist hangers or other means of attachment may be connected to the house band and shall be properly flashed.

GIRDER SUPPORT AND SPANS

AM105.1 Girders shall bear directly on support post with post attached at top to prevent lateral displacement or be connected to the sides of the post with two 5/8-inch hot dipped galvanized bolts with nut and washer. Girder support may be installed per Figure AM105.1(1) for top mount; Figure AM105.1(2) for side mount and Figure AM105.1(3) for split girder detail. PAGES 89 & 90.

Girders may also be cantilevered off ends of support post no more than 1 joist spacing or 16 inches, whichever is greater per Figure AM105.1(4).

JOIST SPANS AND CANTILEVERS

AM106.1 Joist spans shall be based upon Table AM106.1 (ON PAGE 91 OF THIS BOOKLET) with **40lbs. per sq. ft. live load and 10lbs. per sq. ft. dead load. Floor joists supporting Light-frame Exterior Bearing Wall and Roof for Exterior Decks** shall be in accordance with Table R502.3.1(2) Cantilevered floor joists shall be in accordance with Table R502.3.3(1) (ON PAGES 60 & 61 **RESPECTIVELY** OF THIS BOOKLET)

CAUTION: The current method of chemically preserving lumber are much more corrosive to hardware and fasteners than those used in the past. The use of **APPROVED** corrosion resistant hardware, structural connectors and fasteners is required. (Example; ACQ treated lumber would require the use of ACQ approved or triple galvanized hardware.)

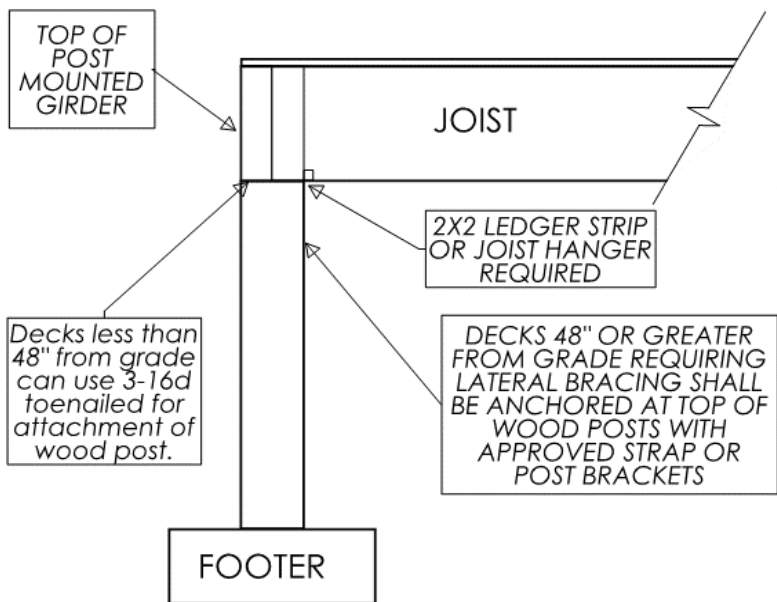


FIGURE AM 105.1(1)

Source: 2018 NC State Residential Code

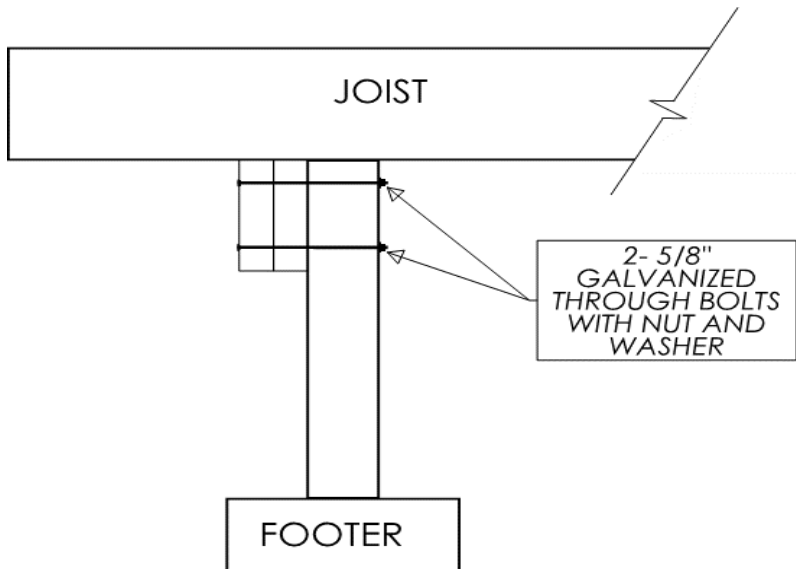


FIGURE AM 105.1(1)

Source: 2018 NC State Residential Code

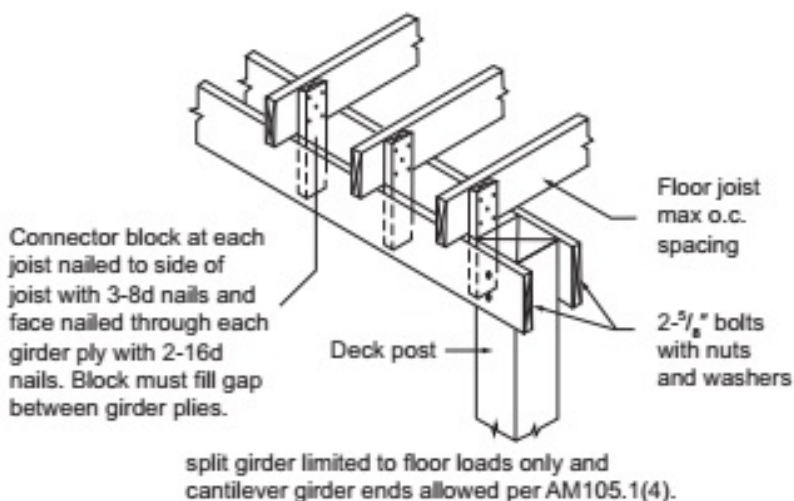


FIGURE AM 105.1(3)

Source: 2018 NC State Residential Code

TABLE AM105.2

DECK GIRDER SPAN LENGTHS ^{a, b} (feet-inches)

Source: 2018 NC State Residential Code

SPECIES ^c	SIZE ^d	DECK JOIST SPAN LESS THAN OR EQUAL TO:						
		(feet)						
		6	8	10	12	14	16	18
Southern Pine	2-2x6	6-11	5-11	5-4	4-10	4-6	4-3	4-0
	2-2x8	8-9	7-7	6-9	6-2	5-9	5-4	5-0
	2-2x10	10-4	9-0	8-0	7-4	6-9	6-4	6-0
	2-2x12	12-2	10-7	9-5	8-7	8-0	7-6	7-0
	3-2x6	8-2	7-5	6-8	6-1	5-8	5-3	5-0
	3-2x8	10-10	9-6	8-6	7-9	7-2	6-8	6-4
	3-2x10	13-0	11-3	10-0	9-2	8-6	7-11	7-6
	3-2x12	15-3	13-3	11-10	10-9	10-0	9-4	8-10

For SI: 1 inch = 25.4mm, 1 foot = 304.8 mm

- Ground snow load, live load = 40psf, dead load = 10psf, L/Δ 360 at main span, L/Δ = 180 at cantilever w/ a 220-pound point load applied at the end.
- Girders supporting deck joists from one side only.
- NO. 2 grade, wet service factor.

- d. Girder depth shall be greater than or equal to depth of joists w/ aflush beam condition.
- e. Includes incising factor.
- f. Northern species, incising factor not included.

TABLE AM106.1

DECK JOIST SPANS FOR COMMON LUMBER SPECIES ^f (feet-inches)

Source: 2018 NC State Residential Code

SPECIES ^a	SIZE	SPACING OF DECK JOISTS W/O CANTILEVER ^b			SPACING OF DECK JOISTS W/ CANTILEVER ^c		
		12	16	24	12	16	24
Southern Pine	2x6	9-11	9-0	7-7	6-8	6-8	6-8
	2x8	13-1	11-10	9-8	10-1	10-1	10-1
	2x10	16-2	14-0	11-5	14-6	14-0	11-5
	2x12	18-0	16-6	13-6	18-0	16-6	13-6

For SI: 1 inch = 25.4mm, 1 foot = 304.8 mm

- a. No. 2 grade with wet service factor.
- b. Ground snow load, live load = 40psf, dead load = 10psf, $L/\Delta = 360$.
- c. Ground snow load, live load = 40psf, dead load = 10psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever w/ a 220-pound point load applied at the end.
- d. Includes incising factor.
- e. Northern species w/ no incising factor.
- f. Cantilevered spans not exceeding the nominal depth of the joist are permitted.

AM108.1

Maximum Height of Deck Support Posts are set forth according to the following Table AM108.1:

Source: 2018 NC State Residential Code

POST SIZE ^a	MAXIMUM POST HEIGHT ^{b, c}
4X4	8'-0"
6X6	20'-0"

- a. This table is based on No. 2 treated Southern Pine posts.
- b. From top of footing to bottom of girder.
- c. Decks with post heights exceeding these requirements shall be designed by a registered design professional. Maximum Tributary Area is based on 128 total square feet with may be located at different levels.

DECK BRACING SECTION

AM109.1 Decks shall be braced to provide lateral stability. The following are acceptable means to provide lateral stability:

AM109.1.1 When the deck floor height is less than 4'-0" above finished grade per Figure AM109.1(1) and the deck is attached to the structure in accordance with Section AM104, lateral bracing is not required.

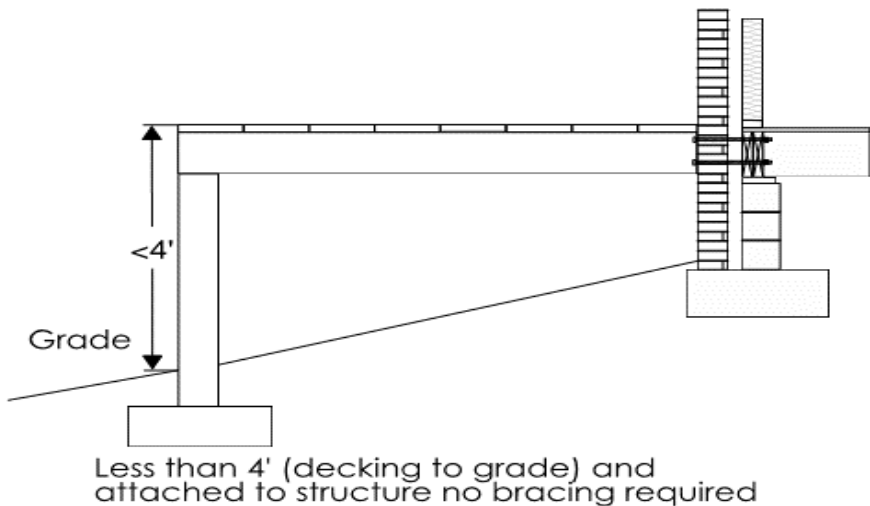


FIGURE AM109.1(1)

Source: 2018 NC State Residential Code

AM109.1.2 4x4 wood knee braces may be provided on each column in both directions. The knee braces shall attach to each post at a point not less than 1/3 of the post length from the top of the post, and the braces shall be angled between 45 degrees and 60 degrees from the horizontal. Knee braces shall be bolted to the post and the girder/double band with one 5/8-inch hot dipped galvanized bolt with nut and washer at both ends of the brace per Figure AM109.1(2)

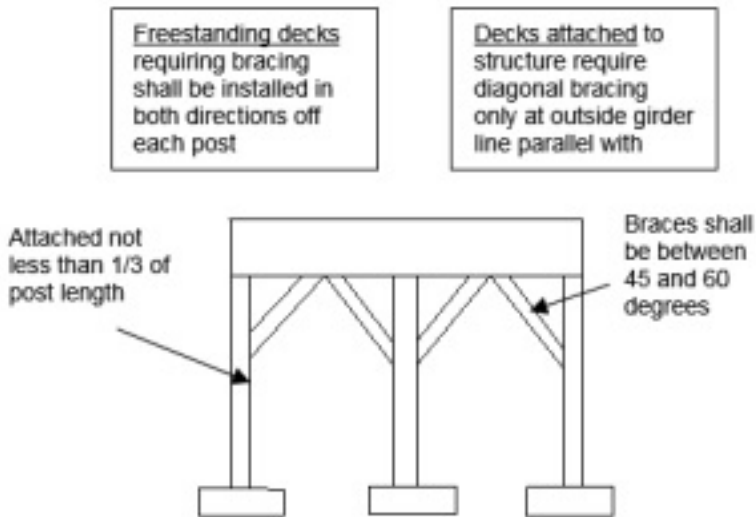


FIGURE AM109.1(2)

Source: 2018 NC State Residential Code

AM109.1.3 For free standing decks without knee braces or diagonal bracing, lateral stability may be provided by embedding the post in accordance with Figure AM109.1(3) and the following Table AM109.1:

Source: 2018 NC State Residential Code

POST SIZE	MAXIMUM TRIBUTARY AREA	MAXIMUM POST HEIGHT	EMBEDMENT DEPTH	CONCRETE DIAMETER
4x4	48 SF	4'-0'	2'-6"	1'-0"
6x6	120 SF	6'-0"	3'-6"	1'-8"

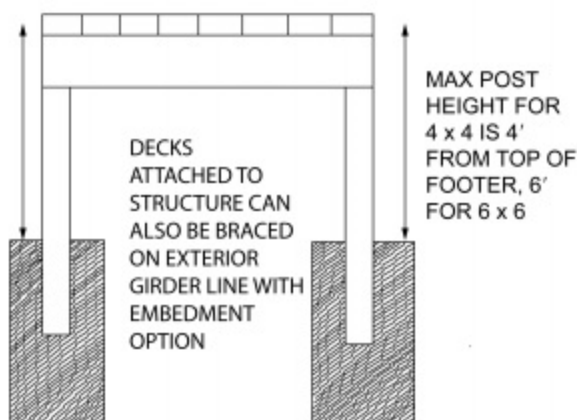


FIGURE AM109.1(3)

Source: 2018 NC State Residential Code

AM109.1.4 2 x 6 diagonal vertical cross bracing may be provided in two perpendicular directions for freestanding decks or parallel to the structure at the exterior column line for attached decks. The 2 x 6's shall be attached to the posts with one 5/8-inch hot dipped galvanized bolt with nut and washer at each end of each bracing member **PER FIGURE AM109.1(4)**

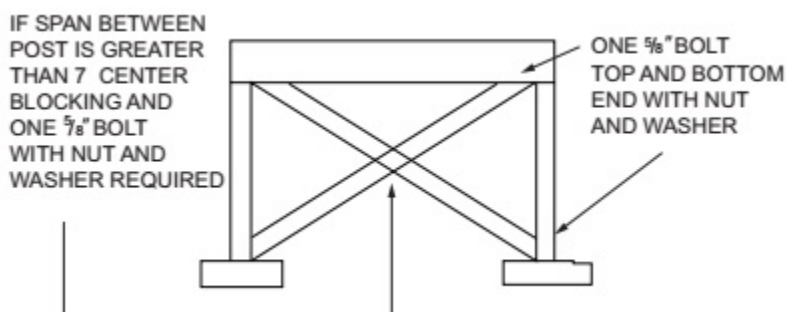


FIGURE AM109.1(4)

Source: 2018 NC State Residential Code

FLOOR DECKING

AM107.1 A floor decking shall be No. 2 grade treated Southern Pine or equivalent. The minimum floor decking thickness shall be according to the following Table AM107.1:

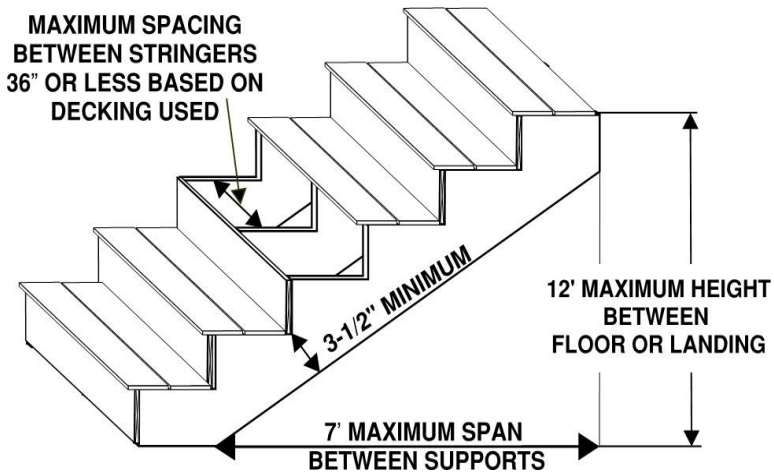
JOIST SPACING	DECKING (NOMINAL)
12" – O.C.	1" S4S
16" - O.C.	1' T & G
24" - O.C.	1 1/4" S4S
32 " – O.C.	2" S4S

Source: NC State Residential Code

STAIRS

AM110 STAIRS SHALL BE CONSTRUCTED PER FIGURE BELOW.

STRINGER SPANS SHALL BE NO GREATER THAN 7 FEET BETWEEN SUPPORTS. SPACING BETWEEN STRINGERS SHALL BE BASED UPON DECKING MATERIAL USED PER FLOOR DECKING MATERIAL USED PER AM107.1 ABOVE. EACH STRINGER SHALL HAVE A MINIMUM 3 1/2 INCHES BETWEEN STEP CUT AND THE BACK OF THE STRINGER. IF USED, SUSPENDED HEADERS SHALL BE ATTACHED WITH 3/8 INCH GALVANIZED BOLTS WITH NUTS AND WASHERS TO SECURELY SUPPORT STRINGERS AT THE TOP.



HANDRAILS, GUARDS, AND GENERAL

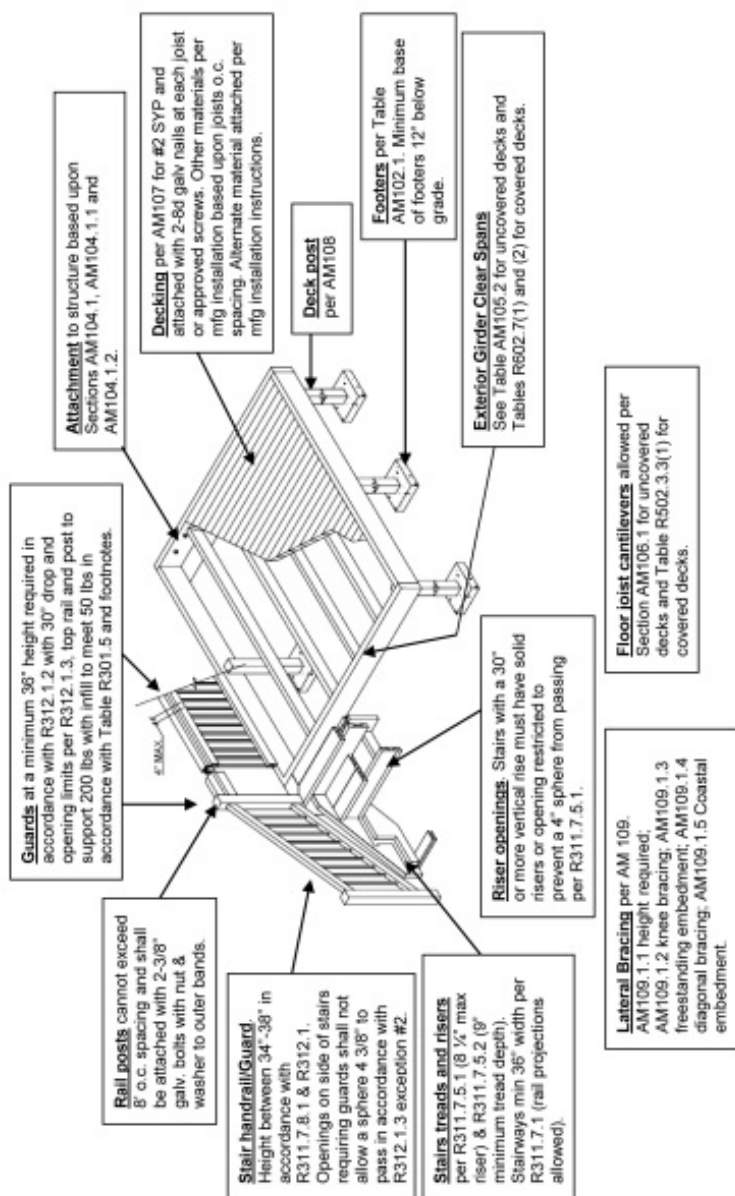


FIGURE AM111.1

Source: 2018 NC State Residential Code

SWIMMING POOLS, SPAS & HOT TUBS

1. What are the requirements for swimming pool, spa and hot tub barriers or fences?

Appendix V Section AV105.2. An outdoor swimming pool, including an in ground, above-ground or on-ground pool, hot tub or spa shall be surrounded by a barrier which shall comply with the following:

- i. The top of the barrier shall be at least 48 inches (1219mm) above grade measured on the side of the barrier which faces away from the swimming pool. Where the top of the pool structure is above grade, such as an above-ground pool, the barrier may be at ground level, such as the pool structure, or mounted on top of the pool structure. The maximum vertical clearance between grade and the bottom of the barrier shall be 2 inches (51 mm) measured on the side of the barrier which faces away from the swimming pool. Where the barrier is mounted on top of the pool structure, the maximum vertical clearance between the top of the pool structure and the bottom of the barrier shall be 4 inches (102 mm).
- ii. Openings in the barrier shall not allow passage of a 4-inch diameter (102 mm) sphere.
- iii. Solid barriers which do not have openings, such as a masonry or stone wall, shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints.
- iv. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is less than 45 inches (1143 mm), the horizontal members shall be located on the swimming pool side of the fence. Spacing between vertical members shall not exceed 1-3/4 inches (44 mm) in width.
- v. Where the barrier is composed of horizontal and vertical members and the distance between the tops of the horizontal members is 45 inches (1143 mm) or more, spacing between vertical members shall not exceed 4 inches (102mm). Where there are decorative cutouts

within vertical members, spacing within the cutouts shall not exceed 1-3/4 inches (44 mm) in width.

- vi. Maximum mesh size for chain link fences shall be a 2- 1/4-inch (57 mm) square unless the fence has slats fastened at the top or the bottom which reduce the openings to not more than 1-3/4 inches (44 mm).
- vii. Where the barrier is composed of diagonal members, such as a lattice fence, the maximum opening formed by the diagonal members shall not be more than 1-3/4 inches (44 mm).
- viii. Access gates shall comply with the requirements of Section AG105.2, Items 1 through 7, and shall be equipped to accommodate a locking device. Pedestrian access gates shall open outward away from the pool and shall be self-closing and have a self-latching device. Gates other than pedestrian access gates shall have a self-latching device. Where the release mechanism of the self-latching device is located less than 54 inches (1372 mm) from the bottom of the gate, the release mechanism and openings shall comply with the following:
 - 1. The release mechanism shall be located on the pool side of the gate at least 3 inches (76mm) below the top of the gate; AND
 - 2. The gate and barrier shall have no opening larger than 1/2 inch (12.7 mm) within 18 inches (457mm) of the release mechanism.
- ix. Where a wall of a dwelling serves as part of the barrier, **ONE** of the following conditions shall be met:
 - 1. The pool shall be equipped with a powered safety cover in compliance with ASTM F1346; **OR**
 - 2. Doors with direct access to the pool through that wall shall be equipped with an alarm which produces an audible warning when the door and/or its screen, if present, are opened. The alarm shall be listed and labeled in accordance with **UL 2017**. The deactivation switch(es) shall be located at least 54 inches (1372

mm) above the threshold of the door; **OR**

3. Other means of protection, such as self-closing doors with self-latching devices, which are approved by the governing body, shall be acceptable as long as the degree of protection afforded is not less than the protection afforded by Item 9.1 or 9.2 described above.

2. What are the requirements for above ground swimming pools?

Where an above-ground pool structure is used as a barrier or where the barrier is mounted on top of the pool structure, and the means of access is a ladder or steps:

- i. The ladder or steps shall be capable of being secured, locked or removed to prevent access: **OR**
- ii. The ladder or steps shall be surrounded by a barrier which meets the requirements of Section AV105.2, Items 1 through 9. When the ladder or steps are secured, locked or removed, any opening created shall not allow the passage of a 4-inch-diameter (102 mm) sphere.

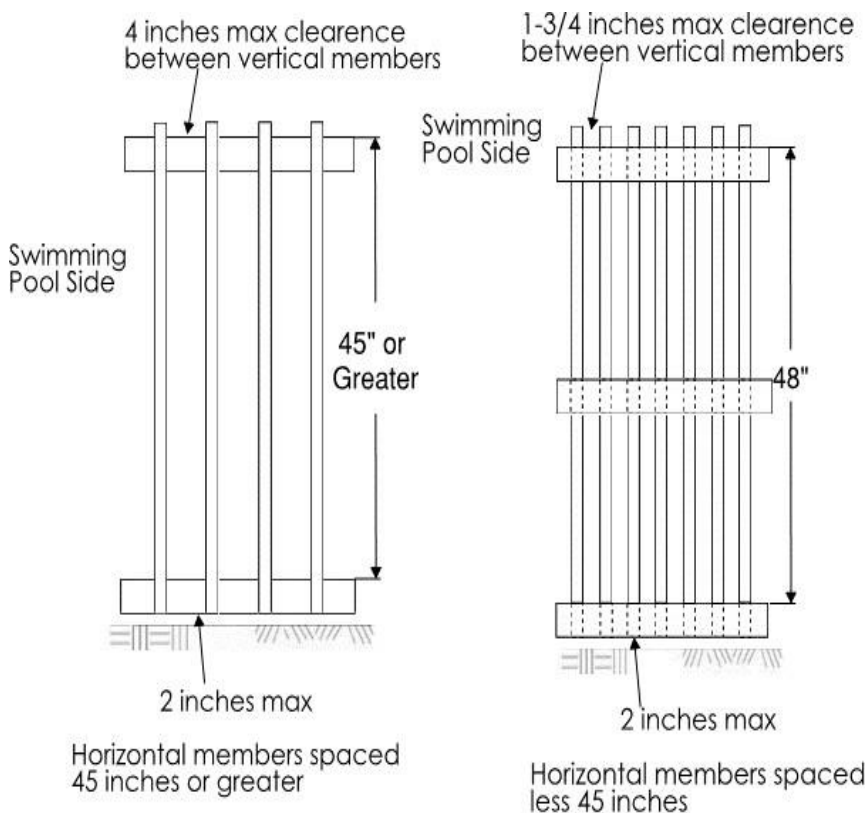
3. What are the requirements for spas and hot tubs?

Spas or hot tubs with a safety cover which complies with ASTM F 1346, as listed in **Section AV107**, shall be exempt from the provisions of this appendix.

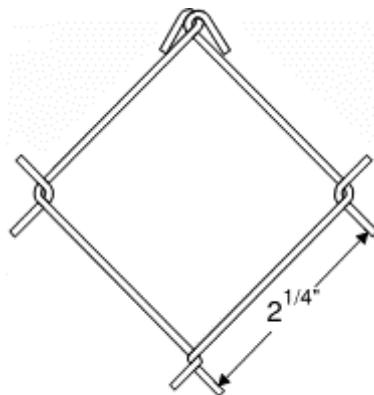
4. What are the requirements for entrapment protection for swimming pool and spa suction outlets?

AV106.1 Suction outlets shall be designed and installed in accordance with **ANSI/APSP-7**.

MINIMUM FENCE REQUIREMENTS



PRIVATE SWIMMING POOL BARRIER CONSTRUCTION



CHAIN-LINK FENCE MESH FOR PRIVATE SWIMMING POOLS

RESIDENTIAL SALES CENTER REQUIREMENTS

When Sales Centers are located in the model home, portions of house must comply with some accessibility requirements depending on where the sales center is located within the house. The simplest scenario is to utilize an attached garage. The other option is to utilize other rooms of the house as the sales center. Additional information regarding accessibility requirements can be found in a document from the Department of Insurance, [Model Home Access https://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/Code_Enforcement_Resources/Handouts-Specific%20Topics/Model%20Home%20Access_.pdf](https://www.ncdoi.com/OSFM/Engineering_and_Codes/Documents/Code_Enforcement_Resources/Handouts-Specific%20Topics/Model%20Home%20Access_.pdf)

Requirements for a sales center in a garage:

- One van accessible parking space.
- Assessible route from the parking space to the garage/sales center.
- Accessible entrance into the garage/sales center.
- Accessible bathroom (an accessible port-a-potty is an option, provided any other bathrooms within the house are disabled).
- A virtual tour must be available to all model homes.

Requirements for a model home sales center are as follows:

- One van accessible parking space.
- Assessible route from the parking space to the model home.
- Accessible entrance into the model home.
- Accessible bathroom (an accessible port-a-potty is an option, provided any other bathrooms within the house are disabled).
- A virtual tour must be available to all model homes.

Details on how to meet the requirements listed above may be found in the 2009 ICC A117.1 Accessible and Usable Buildings and Facilities.

When a model home is being utilized as a sales center, it must be identified during the permitting process. When the model home is sold, any work to convert the sales center into a garage or into a more conventional living space must be permitted.

Any concerns about meeting these requirements at a specific jobsite should be discussed with an area field inspector prior to installation.

